



# STIC Search Report

EIC 1700

STIC Database Tracking Number: 184360

**TO: Raymond Alejandro**

**Location: REM 6B59**

**Art Unit : 1745**

**April 17, 2006**

**Case Serial Number: 10/671902**

**From: Mei Huang**

**Location: EIC 1700**

**REMSEN 4B28**

**Phone: 571/272-3952**

**Mei.huang@uspto.gov**

## Search Notes

Examiner Alejandro,

Please feel free to contact me if you have any questions or if you would like to refine the search query,

Thank you for using STIC services!

Mei Huang



Access DB# 184560

# SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Raymond Alejandro Examiner #: 76895 Date: 04/06/06  
Art Unit: 1745 Phone Number: 302-1282 Serial Number: 101671902  
Mail Box and Bldg/Room Location: Room 6B-59 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

\*\*\*\*\*

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Solid Oxide Fuel Cell Stack Assembly having Tapered Diffusion layers  
Inventors (please provide full names): Milliken et al

Earliest Priority Filing Date: 09/25/03

\*For Sequence Searches Only\* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please, search for the subject matter of claims 1-18.

## STAFF USE ONLY

Searcher: M&H  
Searcher Phone #: \_\_\_\_\_  
Searcher Location: \_\_\_\_\_  
Date Searcher Picked Up: \_\_\_\_\_  
Date Completed: 4/17/06  
Searcher Prep & Review Time: \_\_\_\_\_  
Clerical Prep Time: \_\_\_\_\_  
Online Time: \_\_\_\_\_

### Type of Search

NA Sequence (#) \_\_\_\_\_  
AA Sequence (#) \_\_\_\_\_  
Structure (#) \_\_\_\_\_  
Bibliographic \_\_\_\_\_  
Litigation \_\_\_\_\_  
Fulltext ☒ \_\_\_\_\_  
Patent Family \_\_\_\_\_  
Other \_\_\_\_\_

### Vendors and cost where applicable

STN ☒ \_\_\_\_\_  
Dialog \_\_\_\_\_  
Questel/Orbit \_\_\_\_\_  
Dr.Link \_\_\_\_\_  
Lexis/Nexis \_\_\_\_\_  
Sequence Systems \_\_\_\_\_  
WWW/Internet \_\_\_\_\_  
Other (specify) \_\_\_\_\_

=> fil reg

FILE 'REGISTRY' ENTERED AT 14:33:59 ON 17 APR 2006

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Property values tagged with IC are from the ZIC/VINITI data file provided by InfoChem.

STRUCTURE FILE UPDATES: 16 APR 2006 HIGHEST RN 880543-27-1

DICTIONARY FILE UPDATES: 16 APR 2006 HIGHEST RN 880543-27-1

New CAS Information Use Policies, enter HELP USAGETERMS for details.

TSCA INFORMATION NOW CURRENT THROUGH January 6, 2006

Please note that search-term pricing does apply when conducting SmartSELECT searches.

\*\*\*\*\*  
\*  
\* The CA roles and document type information have been removed from \*  
\* the IDE default display format and the ED field has been added, \*  
\* effective March 20, 2005. A new display format, IDERL, is now \*  
\* available and contains the CA role and document type information. \*  
\*  
\*\*\*\*\*

Structure search iteration limits have been increased. See HELP SLIMITS for details.

REGISTRY includes numerically searchable data for experimental and predicted properties as well as tags indicating availability of experimental property data in the original document. For information on property searching in REGISTRY, refer to:

<http://www.cas.org/ONLINE/UG/regprops.html>

=> fil hcap

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FILE COVERS 1907 - 17 Apr 2006 VOL 144 ISS 17

FILE LAST UPDATED: 16 Apr 2006 (20060416/ED)

New CAS Information Use Policies, enter HELP USAGETERMS for details.

This file contains CAS Registry Numbers for easy and accurate substance identification.

=> fil wpix

FILE 'WPIX' ENTERED AT 14:34:08 ON 17 APR 2006  
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FILE LAST UPDATED: 13 APR 2006 <20060413/UP>  
MOST RECENT DERWENT UPDATE: 200625 <200625/DW>  
DERWENT WORLD PATENTS INDEX SUBSCRIBER FILE, COVERS 1963 TO DATE

>>> FOR A COPY OF THE DERWENT WORLD PATENTS INDEX STN USER GUIDE,  
PLEASE VISIT:  
[http://www.stn-international.de/training\\_center/patents/stn\\_guide.pdf](http://www.stn-international.de/training_center/patents/stn_guide.pdf) <

>>> FOR DETAILS OF THE PATENTS COVERED IN CURRENT UPDATES, SEE  
<http://scientific.thomson.com/support/patents/coverage/latestupdates/>

>>> PLEASE BE AWARE OF THE NEW IPC REFORM IN 2006, SEE  
[http://www.stn-international.de/stndatabases/details/ipc\\_reform.html](http://www.stn-international.de/stndatabases/details/ipc_reform.html) and  
<http://scientific.thomson.com/media/scpdf/ipcrdwpf.pdf> <<<

>>> UPCOMING NEW DWPI: EFFECTS ON SCRIPT RUNS - SEE NEWS MESSAGE <<<

=> fil japio

FILE 'JAPIO' ENTERED AT 14:34:13 ON 17 APR 2006  
COPYRIGHT (C) 2006 Japanese Patent Office (JPO)- JAPIO

FILE LAST UPDATED: 3 APR 2006 <20060403/UP>  
FILE COVERS APRIL 1973 TO DECEMBER 22, 2005

>>> GRAPHIC IMAGES AVAILABLE <<<

>>> NEW IPC8 DATA AND FUNCTIONALITY NOT YET AVAILABLE IN THIS FILE.  
USE IPC7 FORMAT FOR SEARCHING THE IPC. WATCH THIS SPACE FOR FURTHER  
DEVELOPMENTS AND SEE OUR NEWS SECTION FOR FURTHER INFORMATION  
ABOUT THE IPC REFORM <<<

=> fil jicst

FILE 'JICST-EPLUS' ENTERED AT 14:34:18 ON 17 APR 2006  
COPYRIGHT (C) 2006 Japan Science and Technology Agency (JST)

FILE COVERS 1985 TO 11 APR 2006 (20060411/ED)

THE JICST-EPLUS FILE HAS BEEN RELOADED TO REFLECT THE 1999 CONTROLLED  
TERM (/CT) THESAURUS RELOAD.

=> fil compend

FILE 'COMPENDEX' ENTERED AT 14:34:22 ON 17 APR 2006  
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FILE LAST UPDATED: 11 APR 2006 <20060411/UP>  
FILE COVERS 1970 TO DATE.

<<< SIMULTANEOUS LEFT AND RIGHT TRUNCATION AVAILABLE IN  
THE BASIC INDEX >>>

=> fil inspec

FILE 'INSPEC' ENTERED AT 14:34:27 ON 17 APR 2006

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FILE LAST UPDATED: 10 APR 2006 <20060410/UP>  
FILE COVERS 1969 TO DATE.

<<< SIMULTANEOUS LEFT AND RIGHT TRUNCATION AVAILABLE IN  
THE ABSTRACT (/AB), BASIC INDEX (/BI) AND TITLE (/TI) FIELDS >>>

<<< INSPEC HAS BEEN RELOADED AND ENHANCED --> SEE NEWS  
AND HELP CHANGE >>>

=> d his ful

(FILE 'HOME' ENTERED AT 11:30:34 ON 17 APR 2006)

FILE 'HCAPLUS' ENTERED AT 11:30:50 ON 17 APR 2006  
E US20040081875/PN

L1 3 SEA US2004081875/PN

FILE 'REGISTRY' ENTERED AT 11:32:18 ON 17 APR 2006  
2 SEA (7782-44-7/BI OR 1333-74-0/BI)

L2

FILE 'WPIX' ENTERED AT 11:34:42 ON 17 APR 2006  
E US20040081875/PN

L3 1 SEA US2004081875/PN

FILE 'HCAPLUS' ENTERED AT 12:23:03 ON 17 APR 2006

L4 17058 SEA DIFFUS? (A) LAYER#

L5 225 SEA FUEL# (2A) L4

L6 62 SEA (OXYGEN? OR O2?) (2A) L4

L7 4 SEA L5 AND L6

L8 139 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A) L4

L9 60705 SEA FUEL (A) CELL#

L10 15 SEA L9 AND L8

L11 17 SEA L7 OR L10

L12 2893 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A) L9

L13 49 SEA L12 AND L4

L14 10653 SEA ENERGY? (2A) STORAGE?

L15 60 SEA L14 AND L12

L16 19329 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A) ELECTROLY?

L17 16 SEA L13 AND L16

L18 20 SEA L15 AND L16

L19 34 SEA L17 OR L18

L20 49 SEA L11 OR L19

L21 27 SEA L20 AND P/DT

L22 8 SEA L21 AND (1907-2000)/PRY,AY

L23 22 SEA L20 NOT L21

L24 11 SEA L23 NOT (2001-2006)/PY

L25 19 SEA L22 OR L24

FILE 'WPIX' ENTERED AT 13:38:41 ON 17 APR 2006

L26 183 SEA FUEL#(2A)L4  
L27 416 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A)L4  
L28 9 SEA L26 AND L27  
L29 74 SEA (OXYGEN? OR O2?) (2A)L4  
L30 2 SEA L28 AND L29  
L31 9 SEA L28 OR L30  
L32 2322 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A)L9  
L33 8 SEA L32 AND ELECTROLY? (2A)MODE#  
L34 1 SEA L33 AND L29  
L35 1 SEA L33 AND (OXYGEN? OR O2?) (2A)ELECTROD?  
L36 10 SEA L31 OR L34 OR L35

FILE 'JAPIO' ENTERED AT 14:05:06 ON 17 APR 2006

L37 70 SEA FUEL#(2A)L4  
L38 36 SEA (OXYGEN? OR O2?) (2A)L4  
L39 330 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A)L4  
L40 2 SEA L39 AND L37  
L41 0 SEA L40 AND L38  
L42 1621 SEA (OXYGEN? OR O2?) (2A)ELECTROD?  
L43 0 SEA L40 AND L42  
L44 834 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A)L9  
L45 1 SEA L44 AND ELECTROLY? (2A)MODE#  
L46 0 SEA L45 AND L38  
L47 0 SEA L45 AND L42  
L48 3 SEA L40 OR L45

FILE 'JICST-EPLUS' ENTERED AT 14:10:46 ON 17 APR 2006

L49 3 SEA FUEL#(2A)L4  
L50 6 SEA (OXYGEN? OR O2?) (2A)L4  
L51 11 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A)L4  
L52 0 SEA L51 AND L49  
L53 241 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A)L9  
L54 0 SEA L53 AND ECLECTROLY? (2A)MODE#  
L55 0 SEA L52 OR L54

FILE 'COMPENDEX' ENTERED AT 14:21:50 ON 17 APR 2006

L56 18 SEA FUEL#(2A)L4  
L57 23 SEA (OXYGEN? OR O2?) (2A)L4  
L58 36 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A)L4  
L59 0 SEA L58 AND L56  
L60 880 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
TRANSFER? OR CONVERT?) (7A)L9  
L61 5 SEA L60 AND ELECTROLY? (2A)MODE#  
L62 0 SEA L61 AND L57  
L63 0 SEA L61 AND (OXYGEN? OR O2) (2A)ELECTROD?  
L64 0 SEA L61 AND L4

FILE 'INSPEC' ENTERED AT 14:27:29 ON 17 APR 2006

L65 24 SEA FUEL#(2A)L4  
L66 62 SEA (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR  
REDUC?) (3A)L4  
L67 1 SEA L66 AND L65



L68 38 SEA (OXYGEN? OR O2?) (2A)L4  
 L69 0 SEA L68 AND L67  
 L70 1044 SEA (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR  
 TRANSFER? OR CONVERT?) (7A)L9  
 L71 8 SEA L70 AND ELECTROLY? (2A)MODE#  
 L72 0 SEA L71 AND L68  
 L73 2 SEA L71 AND (OXYGEN? OR O2?) (2A)ELECTROD?  
 L74 0 SEA L71 AND L4  
 L75 8 SEA L71 OR L73

FILE 'WPIX' ENTERED AT 14:31:11 ON 17 APR 2006  
 SEL L36 PN, APPS

FILE 'HCAPLUS' ENTERED AT 14:31:43 ON 17 APR 2006  
 L76 17 SEA (US2000-249098P/APPS OR US2001-992272/APPS OR  
 L77 16 SEA L25 NOT L76

FILE 'HCAPLUS, JAPIO, COMPENDEX, INSPEC' ENTERED AT 14:33:30 ON 17  
 APR 2006  
 L78 29 DUP REM L77 L48 L55 L61 L75 (3 DUPLICATES REMOVED)

=> d l36 que stat

L4 17058 SEA FILE=HCAPLUS DIFFUS? (A)LAYER#  
 L9 60705 SEA FILE=HCAPLUS FUEL(A)CELL#  
 L26 183 SEA FILE=WPIX FUEL# (2A)L4  
 L27 416 SEA FILE=WPIX (MODIF? OR CONFIGURAT? OR TAPER? OR  
 NARROW? OR REDUC?) (3A)L4  
 L28 9 SEA FILE=WPIX L26 AND L27  
 L29 74 SEA FILE=WPIX (OXYGEN? OR O2?) (2A)L4  
 L30 2 SEA FILE=WPIX L28 AND L29  
 L31 9 SEA FILE=WPIX L28 OR L30  
 L32 2322 SEA FILE=WPIX (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH?  
 OR TRANSFER? OR CONVERT?) (7A)L9  
 L33 8 SEA FILE=WPIX L32 AND ELECTROLY? (2A)MODE#  
 L34 1 SEA FILE=WPIX L33 AND L29  
 L35 1 SEA FILE=WPIX L33 AND (OXYGEN? OR O2?) (2A)ELECTROD?  
 L36 10 SEA FILE=WPIX L31 OR L34 OR L35

=> d l36 full hitstr 1-10

YOU HAVE REQUESTED DATA FROM FILE 'WPIX' - CONTINUE? (Y)/N:y

L36 ANSWER 1 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN  
 AN 2005-800044 [82] WPIX  
 DNN N2005-662565 DNC C2005-246587  
 TI Fuel cell for automobile use and fixed use for business purpose and  
 household use, includes fluid path provided on fuel  
 diffusion layer and/or oxidant diffusion layer for  
 flowing fluid including active material.  
 DC L03 X16 X21  
 IN XIE, G  
 PA (AISE) AISIN SEIKI KK  
 CYC 38  
 PI EP 1596456 A2 20051116 (200582)\* EN 16 H01M008-10  
 R: AL AT BA BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS  
 IT LI LT LU LV MC MK NL PL PT RO SE SI SK TR YU

JP 2005327613 A 20051124 (200582) 11 H01M008-02  
 US 2005255375 A1 20051117 (200582) H01M004-86  
 ADT EP 1596456 A2 EP 2005-9794 20050504; JP 2005327613 A JP 2004-145026  
 20040514; US 2005255375 A1 US 2005-127087 20050512

PRAI JP 2004-145026 20040514

IC ICM H01M004-86; H01M008-02; H01M008-10

ICS H01M004-94

AB EP 1596456 A UPAB: 20051222

NOVELTY - A fuel cell comprises a fluid path provided on at least one of a **fuel diffusion layer** and an oxidant diffusion layer for flowing fluid including active material.

DETAILED DESCRIPTION - A fuel cell comprises:

(i) an electrolyte (1) configured to be a plane plate;  
 (ii) an anode catalyst layer (2) provided on a first face of the electrolyte;  
 (iii) a cathode catalyst layer (3) provided on a second face of the electrolyte;

(iv) a **fuel diffusion layer** (4) provided on a face of the anode catalyst layer at a back of a second face of the anode catalyst layer facing the electrolyte; and

(v) an oxidant diffusion layer (5) provided on a first face of the cathode catalyst layer at a back of a second face of the cathode catalyst layer facing the electrolyte.

A fluid path is provided on at least one of the **fuel diffusion layer** and the oxidant diffusion layer

(5). Fluid including an active material flows the fluid path void.

USE - For automobile use and fixed use for business purpose and household use.

ADVANTAGE - The assembly can **reduce** pressure loss at **diffusion layer** and manufacturing cost of a separator. The active material for electrode reaction can be directly supplied to the electrode. The pressure loss in the **diffusion layer** can be **reduced**. The manufacturing cost of the diffusion layer having the channel can be reduced.

DESCRIPTION OF DRAWING(S) - The figure shows cross-sectional view of a single cell for a fuel cell.

Electrolyte 1

Anode catalyst layer 2

Cathode catalyst layer 3

**Fuel diffusion layer** 4

Oxidant diffusion layer 5

Anode side separator 6

Cathode side separator 7

Fluid path void 51

Inlet portion 51a

Outlet portion 51a

Channel 51c

Dwg.1/10

TECH EP 1596456 A2 UPTX: 20051222

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred

Component: The fluid path void opens on a first side and a second side of the **fuel diffusion layer**

and/or oxidation diffusion layer. An anode side separator (6) is provided on a first face of the **fuel diffusion layer** at a back of a second face of the **fuel diffusion layer** facing the anode catalyst layer.

A cathode side separator (7) is provided on a first face of the oxidant diffusion layer at a back of a second face of the oxidant diffusion layer facing the cathode catalyst layer. At least one of



the anode side separator and the cathode side separator includes a plane surface facing the **fuel diffusion layer** and/or the oxidant diffusion layer.

The path void includes an inlet portion (51a) for supplying the fluid from outside, an outlet portion (51b) for discharging the fluid to outside, and a channel (51c) for flowing the fluid from the inlet portion to the outlet portion. The channel opens to one of the anode catalyst side or the cathode catalyst layer side and one of the cathode side separator side or the anode side separator side. The electrolyte corresponds to an ion-exchange membrane.

FS CPI EPI  
FA AB; GI  
MC CPI: L03-E04; L03-E04A  
EPI: X16-C01; X16-E06A; X21-A01F; X21-B01A

L36 ANSWER 2 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN

AN 2005-758294 [77] WPIX

CR 2005-702683 [72]

DNN N2005-625769 DNC C2005-231351

TI Proton conducting membrane for fuel cell/fuel cell stack used as electrochemical device for converting energy of chemical reaction into electrical energy, has modified carbon product and polymer e.g. sulfonated polytetrafluoroethylene.

DC A85 E36 L03 X12 X16

IN ATANASSOVA, P; BHATIA, R; CARUSO, J; GURAU, B; HAMPDEN-SMITH, M J; NAPOLITANO, P; RICE, G L; BREWSTER, J

PA (ATAN-I) ATANASSOVA P; (BHAT-I) BHATIA R; (CARU-I) CARUSO J; (GURA-I) GURAU B; (HAMP-I) HAMPDEN-SMITH M J; (NAPO-I) NAPOLITANO P; (RICE-I) RICE G L; (BREW-I) BREWSTER J; (CABO) CABOT CORP

CYC 109

PI WO 2005091416 A2 20050929 (200577)\* EN 177 H01M008-10  
RW: AT BE BG BW CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE  
IS IT KE LS LT LU MC MW MZ NA NL OA PL PT RO SD SE SI SK SL  
SZ TR TZ UG ZM ZW  
W: AE AG AL AM AT AU AZ BA BB BG BR BW BY BZ CA CH CN CO CR CU  
CZ DE DK DM DZ EC EE EG ES FI GB GD GE GH GM HR HU ID IL IN  
IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW  
MX MZ NA NI NO NZ OM PG PH PL PT RO RU SC SD SE SG SK SL SM  
SY TJ TM TN TR TT TZ UA UG US UZ VC VN YU ZA ZM ZW  
US 2005221139 A1 20051006 (200577) H01M008-10  
US 2005221141 A1 20051006 (200577) H01M008-10  
US 2005233183 A1 20051020 (200577) H01M008-00  
US 2005233203 A1 20051020 (200577) H01M004-96

ADT WO 2005091416 A2 WO 2005-US8665 20050315; US 2005221139 A1  
Provisional US 2004-553413P 20040315, Provisional US 2004-553611P  
20040315, Provisional US 2004-553612P 20040315, Provisional US  
2004-553672P 20040315, US 2005-81754 20050315; US 2005221141 A1  
Provisional US 2004-553413P 20040315, Provisional US 2004-553611P  
20040315, Provisional US 2004-553612P 20040315, Provisional US  
2004-553672P 20040315, US 2005-81765 20050315; US 2005233183 A1  
Provisional US 2004-553413P 20040315, Provisional US 2004-553611P  
20040315, Provisional US 2004-553612P 20040315, Provisional US  
2004-553672P 20040315, US 2005-81752 20050315; US 2005233203 A1  
Provisional US 2004-553413P 20040315, Provisional US 2004-553611P  
20040315, Provisional US 2004-553612P 20040315, Provisional US  
2004-553672P 20040315, US 2005-81768 20050315

PRAI US 2004-553672P 20040315; US 2004-553413P 20040315;  
US 2004-553611P 20040315; US 2004-553612P 20040315;  
US 2005-81754 20050315; US 2005-81765 20050315;  
US 2005-81752 20050315; US 2005-81768 20050315

IC ICM H01M004-96; H01M008-00; H01M008-10  
ICS B01J021-18; C08J005-22; H01B001-12; H01M002-00; H01M002-02;  
H01M002-14; H01M004-86; H01M004-88; H01M004-90; H01M004-94;  
H01M008-02

AB WO2005091416 A UPAB: 20051130

NOVELTY - A proton conducting membrane, comprises a modified carbon product and a polymer.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(A) a method for fabrication of a proton conducting membrane, comprising mixing a polymer with a modified carbon product to form a composite mixture; and forming the composite mixture into a proton conducting membrane;

(B) an electrocatalyst comprising an active species phase dispersed on a carbon support structure, where the structure is a modified carbon product;

(C) a fuel cell comprising an electrode containing an electrocatalyst;

(D) a method for making an electrocatalyst, comprising providing a carbon support; covalently attaching a functional group to the carbon support to form a modified carbon support product; and depositing an active species phase on the modified carbon support product to form an electrocatalyst;

(E) a fuel comprising an anode, a cathode, a proton exchange membrane disposed between the anode and the cathode, and further comprising a first gas/fluid diffusion layer adjacent to the anode and opposite the proton exchange membrane and a second gas/fluid diffusion layer adjacent to the cathode and opposite the proton exchange membrane, where at least one of the first and second gas diffusion layers comprises a modified carbon product;

(F) a method for fabrication of a gas diffusion layer in a fuel cell, comprising providing a carbon support; depositing a first ink composition comprising a first modified carbon product on the carbon support to form a first sublayer; and depositing a second ink composition comprising a second modified carbon product over the first sublayer where the first modified carbon product and the second modified carbon product have different hydrophilic properties;

(G) a fuel cell stack, comprising membrane electrode assemblies and at least one bipolar plate separating the membrane electrode assemblies where the bipolar plate comprises at least a first modified carbon product;

(H) a method for treating a current collector having at least a first carbonaceous surface to increase the hydrophobicity of the first carbonaceous surface, comprising covalently bonding a surface-modifying group to the first carbonaceous surface; and

(I) a method for treating a gas distribution system comprising at least a first carbonaceous surface to increase the hydrophobicity of the first carbonaceous surface, comprising covalently bonding a surface-modifying group to the first carbonaceous surface.

USE - The proton conducting membrane is used for fuel cell/fuel cell stack used as electrochemical device that is capable of converting the energy of a chemical reaction into electrical energy without combustion and with virtually no pollution.

ADVANTAGE - The modified carbon products enhance the properties of the components leading to more efficiency within the fuel cell.

DESCRIPTION OF DRAWING(S) - The figures are sectional views of a proton conducting membrane.

Dwg.1/29

TECH WO 2005091416 A2UPTX: 20051130

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Component: The active species phase comprises metal oxide of at least one of gold, Ag, Pt, Pd, Ni, Co, Rh, Ru, Fe, Mn, Cr, Mo, rhenium, W, Ta, Nb, V, Hf, Zr, Ti or Al. The precursor to an active species comprises a Pt compound.

TECHNOLOGY FOCUS - METALLURGY - Preferred Component: The modified carbon product comprises a molecular or ionic metal species bonded to a surface functional group where the metal species is with the electrode layer. The active species phase comprises platinum (Pt), Pt-ruthenium, cobalt (Co), nickel (Ni), PtNiCo, or Pt-chromium-Co (PtCrCo), or iron (Fe). The active species phase comprises Pt, silver (Ag), palladium (Pd), ruthenium (Ru), osmium (Os), Ni, rhodium (Rh), iridium, Co, Cr, molybdenum (Mo), tungsten (W), vanadium (V), niobium (Nb), aluminum (Al), tantalum (Ta), titanium (Ti), zirconium (Zr), hafnium (Hf), zinc, Fe, copper, gallium, indium, silicon, germanium, tin, yttrium, lanthanum, or lanthanide metals. The active species phase comprises an alloy of Pt with at least one metal from Ru, Os, Cr, Ni, manganese (Mn) or Co.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The modified carbon product comprises modified carbon black or proton conducting functional group. The modified carbon product is coated on a surface of the polymer or dispersed within the polymer. The modified carbon product is adapted to conduct protons in the absence of water, or in the presence of other hydrogen-comprising liquid fuels, preferably methanol or ethanol. The modified carbon product is adapted to yield an increased mechanical strength without a decrease in proton conductivity. The modified carbon product comprises at least one proton conducting functional group from SO<sub>3</sub>H, CO<sub>2</sub>H, PO<sub>3</sub>H<sub>2</sub> or PO<sub>3</sub>MH. The modified carbon product comprises proton-conducting functional groups from carboxylic acids, sulfonic acids, phosphonic acid, or phosphonic salts. The modified carbon product comprises modified carbon fibers. The modified carbon product comprises hydrophilic or hydrophobic functional groups. The modified carbon product is adapted to increase the adhesion of the electrode to at least one of an adjacent gas diffusion layer or a proton conducting membrane. The electrode comprises no polymer proton conducting phase. The carbon support comprises carbon black, preferably graphitic carbon. At least one gas diffusion layer comprises a carbon support and a microporous layer disposed on the carbon support, where the microporous layer comprises the modified carbon product. The hydrophilic functional group can be carboxylic acids, carboxylic salts, sulfonic acids, sulfonic salts, phosphonic acids, phosphonic salts, amines, amine salts or alcohols. The hydrophobic functional groups can be optionally saturated cyclics, optionally saturated aliphatics or polymerics. The modified carbon products comprise a steric inhibiting functional group. The at least one gas diffusion layer comprises predominantly hydrophilic modified carbon products on a first side and predominantly hydrophobic modified carbon products on a second side opposite the first side. The gas diffusion layer comprises a major planar surface and a chemical gradient perpendicular to the planar surface. The bipolar plate comprises a gradient hydrophilic structure that is perpendicular or lateral to a major planar surface of the bipolar plate. The bipolar plate comprises a printed hydrophilic or hydrophobic layer comprising the modified carbon product. M=monovalent cation.

Preferred Composition: The proton conducting membrane has a proton conducting group concentration of greater than or equal to 5

(preferably 5.4) mmol/ml. The composite mixture comprises greater than or equal to 20 (preferably greater than or equal to 40) wt.% modified carbon product. The gas diffusion layer comprises 5-70 vol.% of the modified carbon product particles.

Preferred Parameter: The proton conducting membrane has a volume density of a proton conducting groups of greater than or equal to 4.8 mmol/ml. The microporous layer has an average thickness of 2-20 microns. The modified carbon product has an average particle size of 1-30 microns.

Preferred Method: The forming step comprises extruding or casting the composite mixture. The forming step comprises analog or digital deposition. The forming step also comprises dispersing the modified carbon product in a liquid vehicle and ink-jet printing the modified carbon product. The attaching step comprises reacting a diazonium salt in the presence of the carbon support. The step of depositing an active species phase comprises reacting an active species phase precursor in the presence of the modified carbon support product. The active species phase precursor attaches to the surface of the carbon support. The functional group is covalently attached to the carbon by linking group consisting of halogenated alkyl, halogenated aryl, optionally substituted alkyl, optionally substituted aryl, or optionally substituted polymer. The step of covalently attaching a functional group comprises spray processing a precursor solution comprising a carbon material and a diazonium salt. The depositing step comprises spray processing in a spray dryer the precursor solution, where the solution further comprises a precursor to an active species phase. At least one of the depositing steps comprises depositing with an ink-jet device. The depositing steps comprise depositing using spraying, analog deposition, lithography, flexographic printing, slot die, roll-coating, xerography or electrostatic printing. The modified carbon product has been surface modified by the direct reaction of a diazonium salt of formula  $YR-N^+=X^-$ . The hydrophobic layer is printed with a direct-write tool or is digitally printed.

X=anion;

R=linking group;

Y=functional group.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The active species phase comprises metal oxide of at least one of gold, Ag, Pt, Pd, Ni, Co, Rh, Ru, Fe, Mn, Cr, Mo, rhenium, W, Ta, Nb, V, Hf, Zr, Ti or Al. The precursor to an active species comprises a Pt compound.

TECHNOLOGY FOCUS - POLYMERS - Preferred Material: The polymer is sulfonated PTFE or perfluorosulfonated PTFE. The polymer can be polyvinylidene fluoride (PVDF), acid-doped or derivatized fluoride (PVDF), acid-doped or derivatized polybenzimidazole (PBI), polyarylenes, polyetherketones, polysulfones, phosphazenes or polyimides.

Preferred Component: The modified carbon product comprises a functional group that is polymeric or a functional group that is adapted to reduce carbon oxidation or agglomeration of the active species phase.

TECHNOLOGY FOCUS - TEXTILES AND PAPER - Preferred Component: The carbon support comprises carbon cloth or carbon paper.

ABEX WO 2005091416 A2UPTX: 20051130

EXAMPLE - 90 ml Deionized water, 26.5 g treating agent (aminophenylated polyethylene glycol ether, and 2.25 g of 70% aqueous solution of nitric acid were added to a beaker and slowly



mixed. The temperature was slowly raised to 40degreesC using a hot plate, When the temperature reached 40degreesC, 10 g of Vulcan XC-72 carbon black was added and the mixture was stirred and heated to 50degreesC. When the temperature reached 50degreesC, 4.3 g of 20 wt.% aqueous sodium nitrile solution was added slowly drop wise. The mixture was then allowed to react at 50degreesC for 2 hours. When the reaction was complete, the sample was diafiltered using 10 volumes of fresh deionized water to remove any reaction byproducts. The resulting polyethylene glycol-modified Vulcan XC-72 carbon was added to a water/isopropanol solution to give modified carbon solids loading of 55 wt.%. The slurry was cast and dried at 80/oC overnight to form a proton exchange membrane.

FS CPI EPI  
FA AB; GI; DCN  
MC CPI: A12-E06B; E31-N02; L03-E04A2; L03-E04B  
EPI: X12-D01F1; X16-C01C

L36 ANSWER 3 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN  
AN 2005-697186 [72] WPIX  
DNN N2005-572147

TI Gaseous **diffusion layer** for fuel cell  
used for motor vehicle, has micropores and concave portion filled  
with hydrophilic dispersant.

DC X16  
IN MATSUOKA, N  
PA (NSMO) NISSAN MOTOR CO LTD  
CYC 1

PI JP 2005293976 A 20051020 (200572)\* 13 H01M004-86

ADT JP 2005293976 A JP 2004-106012 20040331

PRAI JP 2004-106012 20040331

IC ICM H01M004-86

ICS H01M004-88; H01M008-02; H01M008-10

AB JP2005293976 A UPAB: 20051109

NOVELTY - The composite structure has carbon fiber (25) on which one or more micropores (26) and a concave portion (27) are formed. The micropores and the concave portion are filled with hydrophobic dispersant (20).

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for fuel cell.

USE - For polymer electrode fuel cell used for generating power supply to motor vehicle.

ADVANTAGE - Since hydrophobic dispersant are filled in the micropore and the concave portion, the contact area of the carbon fiber and hydrophobic dispersant is increased. Adhesion is improved. Peeling of the hydrophobic dispersant is prevented and the water-repellent property of a gaseous **diffusion layer** increased. **Reduction** of the battery capability during running the fuel cell over a long period is achieved.

DESCRIPTION OF DRAWING(S) - The figure shows an expanded view of the structure of the gaseous diffusion layer. (Drawing includes non-English language text).

carbon fiber 25

microphone 26

concave portion 26

hydrophobic dispersant 28

Dwg.3/5

FS EPI  
FA AB; GI  
MC EPI: X16-C01; X16-E06

L36 ANSWER 4 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN  
AN 2004-388209 [36] WPIX  
CR 2002-546750 [58]; 2004-329992 [30]  
DNN N2004-309068  
TI Solid-oxide fuel cell system has electronically conductive  
**tapered fuel and oxygen**  
**diffusion layers** having **configuration**  
progressively thicker from innermost edge to outermost edge or from  
outermost edge to innermost edge.

DC X16  
IN MILLIKEN, C E; PETRIK, M A; RUHL, R C  
PA (MILL-I) MILLIKEN C E; (PETR-I) PETRIK M A; (RUHL-I) RUHL R C  
CYC 1  
PI US 2004081875 A1 20040429 (200436)\* 13 H01M008-10  
ADT US 2004081875 A1 Provisional US 2000-249098P 20001115, CIP of US  
2001-992272 20011114, US 2003-671902 20030925  
PRAI US 2000-249098P 20001115; US 2001-992272 20011114;  
US 2003-671902 20030925  
IC ICM H01M008-10  
ICS H01M002-08; H01M002-14  
AB US2004081875 A UPAB: 20040608  
NOVELTY - The electronically conductive **tapered**  
**fuel and oxygen diffusion layers**  
(204,214) allow fuel and oxygen transport through gaseous diffusion,  
respectively. The **diffusion layers** have a  
**configuration** being thicker from innermost edge to outermost  
edge or from outermost edge to innermost edge. An impervious hollow  
planar separator is arranged between tapered side of **fuel**  
and **oxygen diffusion layers**.  
USE - Solid-oxide fuel cell system.  
ADVANTAGE - **Tapered diffusion**  
**layers** provide greatest cross-sectional area for diffusion  
of gases where the diffusion mass fluxes are highest, and lower  
cross-sectional area for diffusion of gases where the diffusion mass  
fluxes are lowest. **Tapered diffusion**  
**layers** thus require smaller total cell thickness.  
DESCRIPTION OF DRAWING(S) - The figure shows a cross-section of  
two fuel cells.  
fuel cell stack 202  
fuel diffusion layer 204  
fuel electrode 206  
oxygen diffusion layer 214  
separator discs 216a,216b  
fuel chamber 220  
air chamber 222  
Dwg.2/4  
FS EPI  
FA AB; GI  
MC EPI: X16-C01A; X16-C15; X16-C16

L36 ANSWER 5 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN  
AN 2004-329992 [30] WPIX  
CR 2002-546750 [58]; 2004-388209 [36]  
DNN N2004-263328 DNC C2004-124986  
TI Electrochemical system e.g. solid-oxide fuel cell system, has  
**tapered fuel diffusion layer**  
and **oxygen diffusion layer**  
progressively thicker towards innermost edge and outermost edge  
respectively.



DC L03 X16  
 IN MILLIKEN, C E; PETRIK, M A; RUHL, R C  
 PA (TECH-N) TECHNOLOGY MANAGEMENT INC  
 CYC 106  
 PI WO 2004030136 A1 20040408 (200430)\* EN 34 H01M008-10  
 RW: AT BE BG CH CY CZ DE DK EA EE ES FI FR GB GH GM GR HU IE IT  
 KE LS LU MC MW MZ NL OA PT RO SD SE SI SK SL SZ TR TZ UG ZM  
 ZW  
 W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ  
 DE DK DM DZ EC EE EG ES FI GB GD GE GH GM HR HU ID IL IN IS  
 JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX  
 MZ NI NO NZ OM PG PH PL PT RO RU SC SD SE SG SK SL SY TJ TM  
 TN TR TT TZ UA UG UZ VC VN YU ZA ZM ZW  
 AU 2003278964 A1 20040419 (200462) H01M008-10  
 EP 1556919 A2 20050727 (200549) EN H01M008-10  
 R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LT  
 LU LV MC MK NL PT RO SE SI SK TR  
 ADT WO 2004030136 A1 WO 2003-US30390 20030926; AU 2003278964 A1 AU  
 2003-278964 20030926; EP 1556919 A2 EP 2003-770475 20030926, WO  
 2003-US30390 20030926  
 FDT AU 2003278964 A1 Based on WO 2004030136; EP 1556919 A2 Based on WO  
 2004030136  
 PRAI US 2003-671902 20030925; US 2002-413858P 20020926  
 IC ICM H01M008-10  
 ICS H01M002-00; H01M002-08  
 AB WO2004030136 A UPAB: 20050802  
 NOVELTY - Cell (200) has electrolyte disc (210) provided between  
 fuel electrode (206) and oxygen electrode (212). **Tapered  
 fuel diffusion layer** (204) gradually  
 thickening towards inner edge, and **oxygen  
 diffusion layer** (214) gradually thickening towards  
 outer edge, are provided with annular seals (208, 218) with  
 respective electrodes. The inclined separators (216a, 216b) separate  
 the cell from adjacent cells.  
 DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included  
 for solid-oxide fuel cell system.  
 USE - Electrochemical system e.g. solid-oxide fuel cell system  
 (claimed) is used for direct conversion of chemical energy into  
 electrical energy.  
 ADVANTAGE - Improves fuel and oxygen diffusion efficiency as  
 the **diffusion layers** are tapered.  
 Prevents low level gas leaks, as common annular seals are provided  
 for the diffusion layers and respective electrodes.  
 DESCRIPTION OF DRAWING(S) - The figure shows a cross sectional  
 view of the two cells of the electrochemical cell stack.  
 Fuel cells 200, 201  
 Electrochemical cell stack 202  
**Fuel diffusion layer** 204  
 Fuel electrode 206  
 Electrolyte disc 210  
 Annular seals 208, 218  
 Oxygen electrode 212  
**Oxygen diffusion layer** 214  
 Separators 216a, 216b  
 Dwg.2/4  
 TECH WO 2004030136 A1UPTX: 20040511  
 TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Device:  
 The **tapered fuel diffusion  
 layer** is tapered in the direction opposite to the  
 direction of the **tapered oxygen**

**diffusion layer.** At least one cell has a shape selected from circular, square, rectangular and oval. At least one hollow planar cell is defined by at least one cavity. An additional electrical contact layer e.g., ink comprising finely-divided electrode composition is applied to at least one side of the separator to improve the electrical contact between the components of the cell.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Materials: The oxygen-containing gas mixture is substantially pure oxygen. The fuel gas mixture comprises steam and hydrogen in each of the modes.

FS CPI EPI

FA AB; GI

MC CPI: L03-E04A1; L03-E04B; L03-E04G

EPI: X16-C01A; X16-E06A; X16-F02

L36 ANSWER 6 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN

AN 2003-902894 [82] WPIX

DNN N2003-721081 DNC C2003-256400

TI Gas diffusion layer for fuel cell  
comprises woven fabric of carbon fiber warp and weft threads.

DC A85 L03 X16

IN HORI, Y; KOSAKO, S; MORITA, J; SAKAI, O; SUGAWARA, Y; TAKEBE, Y;  
UCHIDA, M; YAMAUCHI, M; YASUMOTO, E; YONAMINE, T; YOSHIDA, A

PA (MATU) MATSUSHITA ELECTRIC IND CO LTD; (HORI-I) HORI Y; (KOSA-I)  
KOSAKO S; (MORI-I) MORITA J; (SAKA-I) SAKAI O; (SUGA-I) SUGAWARA Y;  
(TAKE-I) TAKEBE Y; (UCHI-I) UCHIDA M; (YAMA-I) YAMAUCHI M; (YASU-I)  
YASUMOTO E; (YONA-I) YONAMINE T; (YOSH-I) YOSHIDA A

CYC 35

PI WO 2003081700 A1 20031002 (200382)\* JA 58 H01M004-86

RW: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL  
PT RO SE SI SK TR

W: CA CN JP US

EP 1505673 A1 20050209 (200512) EN H01M004-86

R: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LT  
LU LV MC MK NL PT RO SE SI SK TR

US 2005142430 A1 20050630 (200543) H01M004-94

JP 2003579301 X 20050728 (200549) 49 H01M004-96

CN 1650452 A 20050803 (200578) H01M004-86

ADT WO 2003081700 A1 WO 2003-JP3662 20030325; EP 1505673 A1 EP  
2003-712947 20030325, WO 2003-JP3662 20030325; US 2005142430 A1 WO  
2003-JP3662 20030325, US 2004-508971 20041110; JP 2003579301 X JP  
2003-579301 20030325, WO 2003-JP3662 20030325; CN 1650452 A CN  
2003-807218 20030325

FDT EP 1505673 A1 Based on WO 2003081700; JP 2003579301 X Based on WO  
2003081700

PRAI JP 2002-85279 20020326; JP 2002-85273 20020326

IC ICM H01M004-86; H01M004-94; H01M004-96

ICS D01F009-12; D03D015-12; H01M004-88; H01M008-02; H01M008-10

AB WO2003081700 A UPAB: 20031223

NOVELTY - The gas diffusion layer comprises woven fabric of carbon fiber warp and weft threads (41,42). The spacing (X) between neighboring texture points at which warp and weft threads cross each other, and the thickness (Y) of woven fabric satisfy preset relation.

DETAILED DESCRIPTION - The gas diffusion layer comprises woven fabric of carbon fiber warp and weft threads (41,42). The spacing (X) between neighboring texture points at which warp and weft threads cross each other and the thickness (Y) of the woven fabric satisfy the relation (I).

1.4 at most X/Y at most 3.5 (I)

USE - Fuel cell.

ADVANTAGE - The gas diffusion layer

reduces unevenness of substrate surface and avoids sticking of woven fabric with polymer electrolyte film of fuel cell such that microshort circuiting is inhibited. The gas diffusion layer improves performance of the fuel cell.

DESCRIPTION OF DRAWING(S) - The figure shows the gas diffusion layer.

Warp and weft threads 41,42

Spacing between neighboring texture points X

Thickness Y

Dwg.4A/10

FS CPI EPI

FA AB; GI

MC CPI: A12-E06; L03-E04

EPI: X16-C01; X16-C16; X16-E06

L36 ANSWER 7 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN

AN 2003-877742 [81] WPIX

CR 2003-877741 [81]; 2003-877743 [81]; 2004-034719 [03]

DNN N2003-700868 DNC C2003-248007

TI Separator-diffusion layer assembly for fuel cell assembly has diffusion layer comprising electroconductive film formed integrally with separator and formed with fluid paths extending through the diffusion layer.

DC L03 X16

IN KUBOTA, T; KURIYAMA, N; SAITO, Y; SASAHARA, J; SUZUKI, T

PA (HOND) HONDA GIKEN KOGYO KK; (KUBO-I) KUBOTA T; (KURI-I) KURIYAMA N; (SAIT-I) SAITO Y; (SASA-I) SASAHARA J; (SUZU-I) SUZUKI T

CYC 31

PI WO 2003096454 A2 20031120 (200381)\* EN 41 H01M008-00

RW: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LU MC NL

PT RO SE SI SK TR

W: CA JP KR US

EP 1525638 A2 20050427 (200529) EN H01M008-10

R: AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC

NL PT RO SE SI SK TR

US 2005175888 A1 20050811 (200553) H01M004-94

JP 2005529454 W 20050929 (200568) 23 H01M004-86

ADT WO 2003096454 A2 WO 2003-JP5631 20030502; EP 1525638 A2 EP 2003-728026 20030502; WO 2003-JP5631 20030502; US 2005175888 A1 US 2004-979376 20041028; JP 2005529454 W WO 2003-JP5631 20030502, JP 2004-504322 20030502

FDT EP 1525638 A2 Based on WO 2003096454; JP 2005529454 W Based on WO 2003096454

PRAI US 2002-379524P 20020509

IC ICM H01M004-86; H01M004-94; H01M008-00; H01M008-10

ICS H01M004-88; H01M008-02; H01M008-24

AB WO2003096454 A UPAB: 20051024

NOVELTY - Separator-diffusion layer assembly for a fuel cell assembly comprises a diffusion layer on a surface of a separator. The diffusion layer comprises an electroconductive film formed integrally with the separator and is formed with fluid paths extending through the diffusion layer in a direction of its thickness to be in flow communication with a recess of the separator.

DETAILED DESCRIPTION - Separator-diffusion layer assembly (130, 131) for a fuel cell assembly comprises a separator (115, 116) having a first surface formed with a recess (120) through which a

fuel fluid or an oxidizing fluid flows and a second surface opposite to the first surface, and a diffusion layer (113, 114) on the first surface of the separator. The diffusion layer comprises an electroconductive film (133) formed integrally with the separator and is formed with fluid paths extending through the diffusion layer in a direction of its thickness to be in flow communication with the recess of the separator and thus diffuse the fluid in the recess on a side of a surface of the diffusion layer facing away from the first surface of the separator.

INDEPENDENT CLAIMS are also included for the following:

(a) a fuel cell assembly comprising an electrolyte layer, a pair of catalyst electrode layers interposing the electrolyte layer, a pair of separators each having a first surface facing the electrolyte layer and a second surface opposite the first, and a pair of diffusion layers; and

(b) a method for manufacturing a separator-diffusion layer assembly of a fuel cell assembly, which comprises: forming a diffusion layer on a surface of a substrate consisting of an inorganic material; and bringing an etchant into contact with the surface of the substrate through the fluid paths of the diffusion layer to form a recess in the surface of the substrate for allowing a fuel fluid or an oxidizing fluid to flow through the recess and thus making a separator.

USE - The separator-diffusion layer assembly is used for a fuel cell assembly (claimed).

ADVANTAGE - The diffusion layer has a reduced surface roughness, thus decreasing the contact resistance between the diffusion layer and its adjoining component part. It has an increased conductivity, and has a smaller thickness than the conventional diffusion layer, while maintaining a favorable diffusing function. The fuel cell assembly incorporating the separator-diffusion layer assembly eliminates the need for applying a large tightening pressure to the separators and the diffusion layers in the assembled state. This reduces the mechanical strength required to the component parts of the fuel cell assembly, thus decreasing its manufacturing cost. The influence of the stress that may be caused by expansion of the electrolyte layer in operation can be moderated, which eliminates the need for controlling the tightening pressure, and thus simplifies the operation.

DESCRIPTION OF DRAWING(S) - The figure is a schematic cross-sectional view for showing a fuel cell assembly.

Diffusion layer 113, 114

Separator 115, 116

Recess 120

Separator-diffusion layer assembly 130, 131

Electroconductive film 133

Dwg.2/12

TECH WO 2003096454 A2UPTX: 20031216

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Method:

The step of forming a diffusion layer comprises forming the electroconductive film on the surface of the substrate by physical vapor deposition, chemical vapor deposition, spin coating, sputtering, or screen printing. It comprises forming openings in the electroconductive film, where the fluid paths of the diffusion layer comprise the openings formed in the electroconductive film. It comprises forming a structure reinforcement member between the substrate and the electroconductive film, and forming openings in the structure reinforcement member.

FS CPI EPI

FA AB; GI

MC CPI: L03-E04G  
EPI: X16-C; X16-F02

L36 ANSWER 8 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN

AN 2003-067745 [06] WPIX

CR 2003-019585 [01]

DNN N2003-052540 DNC C2003-017796

TI Manufacture of fluid-diffusion layer for  
fuel cell, involves abrading substrate surface to improve  
uniformity of surface topography.

DC A85 L03 P61 X16

IN GORDON, J R; HAAS, H R; PEINECKE, V; VON DER OSTEN-FABECK, J

PA (GORD-I) GORDON J R; (HAAS-I) HAAS H R; (PEIN-I) PEINECKE V;  
(VOST-I) VON DER OSTEN-FABECK J; (BALL-N) BALLARD POWER SYSTEMS INC

CYC 101

PI WO 2002089238 A2 20021107 (200306)\* EN 40 H01M004-96

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC  
MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ  
DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP  
KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ  
NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ  
UA UG US UZ VN YU ZA ZM ZW

US 2002192536 A1 20021219 (200306) H01M004-86

EP 1384277 A2 20040128 (200409) EN H01M004-96

R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK  
NL PT RO SE SI TR

US 6716551 B2 20040406 (200425) H01M002-14

AU 2002257415 A1 20021111 (200433) H01M004-96

AU 2002257415 A8 20051013 (200611) H01M004-96

ADT WO 2002089238 A2 WO 2002-CA646 20020501; US 2002192536 A1 US  
2001-847461 20010502; EP 1384277 A2 EP 2002-727083 20020501, WO  
2002-CA646 20020501; US 6716551 B2 US 2001-847461 20010502; AU  
2002257415 A1 AU 2002-257415 20020501; AU 2002257415 A8 AU  
2002-257415 20020501

FDT EP 1384277 A2 Based on WO 2002089238; AU 2002257415 A1 Based on WO  
2002089238; AU 2002257415 A8 Based on WO 2002089238

PRAI US 2001-859130 20010516; US 2001-847461 20010502

IC ICM H01M002-14; H01M004-86; H01M004-96

ICS B24B007-20; H01M004-88; H01M008-10

AB WO 200289238 A UPAB: 20060214

NOVELTY - A fluid-diffusion layer for a solid polymer electrolyte  
fuel cell having a porous substrate made by abrading substrate  
surface to render the surface topography of the diffusion layer more  
uniform.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the  
following:

(a) A method of manufacturing a fuel cell electrode by applying  
a carbon-supported catalyst to a fluid-diffusion layer; and

(b) A fuel cell comprising a pair of fluid flow plates  
interposing a membrane assembly which includes a pair of electrodes  
containing a fluid-diffusion layer and interposing an ion-exchange  
membrane.

USE - For use in a solid-polymer-electrolyte fuel cell.

ADVANTAGE - The inventive fluid-diffusion  
layer reduces the occurrence of transfer leaks in  
membrane electrode assembly. The manufacturing method of fuel cell  
is simplified and quickened.

DESCRIPTION OF DRAWING(S) - The figure is an optical  
interferometric topographic picture and representative surface



profile of impression of SGL Saracen.

Dwg.1C/4

TECH WO 200289238 A2UPTX: 20030124

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Method:  
The particles formed by abrading operation may be deposited into the pores of the substrate to form a support structure for direct deposition of a catalyst onto the abraded surface. The method may include applying a carbon-containing sublayer to substrate surface before abrasion, applying hydrophobic material (preferably polytetrafluoroethylene) to the substrate, and sintering the substrate after application of hydrophobic material.

Preferred Components: The fluid-diffusion layer may comprise carbon-containing sublayer of hydrophobic material. The substrate comprises non-woven carbon fiber material.

Preferred Properties: The abrading material has an average surface roughness (Ra) that is less than the average Ra of fluid-diffusion layer before abrasion. The fluid-diffusion layer has an average Ra of at least 14  $\mu\text{m}$  (prior to abrasion) and 6-10  $\mu\text{m}$  (after abrasion). The substrate has a pore volume of greater than 80% and an average pore size of greater than 30  $\mu\text{m}$ .

FS CPI EPI GMPI

FA AB; GI

MC CPI: A12-E09; L03-E04A2

EPI: X16-C01C; X16-E06A

L36 ANSWER 9 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN

AN 2002-546750 [58] WPIX

CR 2004-329992 [30]; 2004-388209 [36]

DNN N2002-432796

TI Multipurpose reversible solid oxide fuel

cell system has sealing covering electrodes and diffusion layers for shielding from oxygen gas and fuel gas mixture.

DC X16 X25

IN RUHL, R C *one of the applicants*

PA (TECH-N) TECHNOLOGY MANAGEMENT INC

CYC 90

PI US 2002058175 A1 20020516 (200258)\* 4 H01M008-12

WO 2002041428 A1 20020523 (200258) EN H01M008-04

RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC

MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

W: AE AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES

FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK

LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG

SI SK SL TJ TM TR TT UA UG UZ VN YU ZA ZW

AU 2002019941 A 20020527 (200261) H01M008-04

EP 1348243 A1 20031001 (200365) EN H01M008-04

R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK

NL PT RO SE SI TR

NZ 520519 A 20040326 (200425) H01M008-04

US 6811913 B2 20041102 (200472) H01M008-10

ADT US 2002058175 A1 Provisional US 2000-249098P 20001115, US

2001-992272 20011114; WO 2002041428 A1 WO 2001-US44796 20011115; AU

2002019941 A AU 2002-19941 20011115; EP 1348243 A1 EP 2001-996900

20011115, WO 2001-US44796 20011115; NZ 520519 A NZ 2001-520519

20011115, WO 2001-US44796 20011115; US 6811913 B2 Provisional US

2000-249098P 20001115, US 2001-992272 20011114

FDT AU 2002019941 A Based on WO 2002041428; EP 1348243 A1 Based on WO

2002041428; NZ 520519 A Based on WO 2002041428

PRAI US 2000-249098P 20001115; US 2001-992272 20011114

IC ICM H01M008-04; H01M008-10; H01M008-12



ICS C25B001-10; H01M002-08; H01M004-94  
 AB US2002058175 A UPAB: 20041109  
 NOVELTY - Fuel and oxygen electrodes (24,28) are provided inside electrolyte in hollow planar cells. Electroconductive fuel and oxygen diffusion layers (26,30) contact respective electrodes (24,28).  
 Sealings (32,34) are provided covering the electrodes (24,28) and diffusion layers (26,30), for shielding the electrodes and diffusion layers from fuel gas mixture and oxygen gas.  
 DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for solid oxide fuel cell system operating method.  
 USE - Multipurpose fuel cell system operated in fuel cell mode, electrolysis mode and intermediate mode for directly converting chemical energy into electricity.  
 ADVANTAGE - Increases energy storage efficiency, by using the sealings.  
 DESCRIPTION OF DRAWING(S) - The figure shows a cross-sectional view of two adjacent identical cells contained in a stack of fuel cell system.  
 Fuel electrode 24  
 Electroconductive fuel diffusion layer 26  
 Oxygen electrode 28  
 Oxygen diffusion layer 30  
 Sealings 32,34  
 Dwg.1/1  
 FS EPI  
 FA AB; GI  
 MC EPI: X16-C01A; X16-C16; X25-R01A

L36 ANSWER 10 OF 10 WPIX COPYRIGHT 2006 THE THOMSON CORP on STN  
 AN 2002-025534 [03] WPIX  
 CR 2003-554752 [52]  
 DNN N2002-019799  
 TI Flow field for supporting fluid **diffusion layers** in **fuel** cells, has channels configured so that any unsupported rectangular surface on fluid diffusion layer has ratio of length to width of less than about 3.  
 DC X16  
 IN JOHNSON, M C; KENNA, J; TABATABAIAN, M; VANDERLEEDEN, O R; WILKINSON, D P; ZIMMERMAN, J  
 PA (BALL-N) BALLARD POWER SYSTEMS INC; (VAND-I) VANDERLEEDEN O R; (WILK-I) WILKINSON D P; (ZIMM-I) ZIMMERMAN J  
 CYC 2  
 PI US 2001041281 A1 20011115 (200203)\* 10 H01M008-04  
 CA 2347199 A1 20011109 (200203) EN H01M008-04  
 CA 2347203 A1 20011109 (200203) EN H01M008-04  
 US 6541145 B2 20030401 (200324) H01M002-00  
 ADT US 2001041281 A1 CIP of US 2000-567500 20000509, US 2000-752548 20001228; CA 2347199 A1 CA 2001-2347199 20010509; CA 2347203 A1 CA 2001-2347203 20010509; US 6541145 B2 CIP of US 2000-567500 20000509, US 2000-752548 20001228  
 PRAI US 2000-752548 20001228; US 2000-567500 20000509  
 IC ICM H01M002-00; H01M008-04  
 ICS H01M004-94; H01M008-00  
 AB US2001041281 A UPAB: 20030813  
 NOVELTY - The flow field comprises one or more fluid distribution channels (16,18) having an average channel width W and separated by landings. The fluid diffusion electrode comprises a fluid diffusion layer (7,8), and the landings in the flow field mechanically support the fluid distribution layer. The one or more channels are

configured such that any unsupported rectangular surface of length L and width W on the fluid diffusion layer has a ratio L/W less than about 3.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for a fuel cell and a method of supporting fluid diffusion layer in fuel cell with flow field.

USE - For supporting fluid diffusion layers in solid polymer electrolyte fuel cell.

ADVANTAGE - Provides improved mechanical support from adjacent flow field plates.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic diagram of a solid polymer electrolyte fuel cell stack.

fluid diffusion layer 7,8

fluid distribution channels 16,18

Dwg.1/4

FS EPI  
FA AB; GI  
MC EPI: X16-C01C; X16-C09; X16-C15

=> d 178 que stat

L4 17058 SEA FILE=HCAPLUS DIFFUS? (A) LAYER#  
L5 225 SEA FILE=HCAPLUS FUEL# (2A) L4  
L6 62 SEA FILE=HCAPLUS (OXYGEN? OR O2?) (2A) L4  
L7 4 SEA FILE=HCAPLUS L5 AND L6  
L8 139 SEA FILE=HCAPLUS (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR REDUC?) (3A) L4  
L9 60705 SEA FILE=HCAPLUS FUEL (A) CELL#  
L10 15 SEA FILE=HCAPLUS L9 AND L8  
L11 17 SEA FILE=HCAPLUS L7 OR L10  
L12 2893 SEA FILE=HCAPLUS (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR TRANSFER? OR CONVERT?) (7A) L9  
L13 49 SEA FILE=HCAPLUS L12 AND L4  
L14 10653 SEA FILE=HCAPLUS ENERGY? (2A) STORAGE?  
L15 60 SEA FILE=HCAPLUS L14 AND L12  
L16 19329 SEA FILE=HCAPLUS (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR TRANSFER? OR CONVERT?) (7A) ELECTROLY?  
L17 16 SEA FILE=HCAPLUS L13 AND L16  
L18 20 SEA FILE=HCAPLUS L15 AND L16  
L19 34 SEA FILE=HCAPLUS L17 OR L18  
L20 49 SEA FILE=HCAPLUS L11 OR L19  
L21 27 SEA FILE=HCAPLUS L20 AND P/DT  
L22 8 SEA FILE=HCAPLUS L21 AND (1907-2000)/PRY,AY  
L23 22 SEA FILE=HCAPLUS L20 NOT L21  
L24 11 SEA FILE=HCAPLUS L23 NOT (2001-2006)/PY  
L25 19 SEA FILE=HCAPLUS L22 OR L24  
L37 70 SEA FILE=JAPIO FUEL# (2A) L4  
L39 330 SEA FILE=JAPIO (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR REDUC?) (3A) L4  
L40 2 SEA FILE=JAPIO L39 AND L37  
L44 834 SEA FILE=JAPIO (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR TRANSFER? OR CONVERT?) (7A) L9  
L45 1 SEA FILE=JAPIO L44 AND ELECTROLY? (2A) MODE#  
L48 3 SEA FILE=JAPIO L40 OR L45  
L49 3 SEA FILE=JICST-EPLUS FUEL# (2A) L4  
L51 11 SEA FILE=JICST-EPLUS (MODIF? OR CONFIGURAT? OR TAPER? OR NARROW? OR REDUC?) (3A) L4  
L52 0 SEA FILE=JICST-EPLUS L51 AND L49  
L53 241 SEA FILE=JICST-EPLUS (ALTERNAT? OR REVERS? OR CHANG? OR SWITCH? OR TRANSFER? OR CONVERT?) (7A) L9

L54 0 SEA FILE=JICST-EPLUS L53 AND ECLECTROLY?(2A)MODE#  
 L55 0 SEA FILE=JICST-EPLUS L52 OR L54  
 L60 880 SEA FILE=COMPENDEX (ALTERNAT? OR REVERS? OR CHANG? OR  
 SWITCH? OR TRANSFER? OR CONVERT?)(7A)L9  
 L61 5 SEA FILE=COMPENDEX L60 AND ELECTROLY?(2A)MODE#  
 L70 1044 SEA FILE=INSPEC (ALTERNAT? OR REVERS? OR CHANG? OR  
 SWITCH? OR TRANSFER? OR CONVERT?)(7A)L9  
 L71 8 SEA FILE=INSPEC L70 AND ELECTROLY?(2A)MODE#  
 L73 2 SEA FILE=INSPEC L71 AND (OXYGEN? OR O2?)(2A)ELECTROD?  
 L75 8 SEA FILE=INSPEC L71 OR L73  
 L76 17 SEA FILE=HCAPLUS (US2000-249098P/APPS OR US2001-992272/AP  
 PS OR US2004-553413P/APPS OR US2004-553611P/APPS OR  
 US2004-553612P/APPS OR US2004-553672P/APPS OR WO2003-JP36  
 62/APPS OR US2000-567500/APPS OR US2000-752548/APPS OR  
 US2001-847461/APPS OR US2003-671902/APPS OR WO2001-US4479  
 6/APPS OR WO2003-JP5631/APPS OR AU2002-257415/APPS OR  
 AU2002257415/PN OR JP2004-106012/APPS OR JP2004-145026/AP  
 PS OR US2005-81752/APPS OR US2005-81754/APPS OR US2005-81  
 765/APPS OR US2005-81768/APPS OR WO2002-CA646/APPS OR  
 WO2003-US30390/APPS OR AU2002-19941/APPS OR AU2002019941/  
 PN OR AU2003-278964/APPS OR AU2003278964/PN OR CA2001-234  
 7199/APPS OR CA2001-2347203/APPS OR CA2347199/PN OR  
 CA2347203/PN OR CN1650452/PN OR CN2003-807218/APPS OR  
 EP1348243/PN OR EP1384277/PN OR EP1505673/PN OR EP1525638  
 /PN OR EP1556919/PN OR EP1596456/PN OR EP2001-996900/APPS  
 OR EP2002-727083/APPS OR EP2003-712947/APPS OR EP2003-72  
 8026/APPS OR EP2003-770475/APPS OR EP2005-9794/APPS OR  
 JP2002-85273/APPS OR JP2002-85279/APPS OR JP2003-579301/A  
 PPS OR JP2003579301/PN OR JP2004-504322/APPS OR JP2005293  
 976/PN OR JP2005327613/PN OR JP2005529454/PN OR NZ2001-52  
 0519/APPS OR NZ520519/PN OR US2001-859130/APPS OR  
 US2001041281/PN OR US2002-379524P/APPS OR US2002-413858P/  
 APPS OR US2002058175/PN OR US2002192536/PN OR US2004-5089  
 71/APPS OR US2004-979376/APPS OR US2004081875/PN OR  
 US2005-127087/APPS OR US2005142430/PN OR US2005175888/PN  
 OR US2005221139/PN OR US2005221141/PN OR US2005233183/PN  
 OR US2005233203/PN OR US2005255375/PN OR US6541145/PN OR  
 US6716551/PN OR US6811913/PN OR WO2002041428/PN OR  
 WO2002089238/PN OR WO2003081700/PN OR WO2003096454/PN OR  
 WO2004030136/PN OR WO2005-US8665/APPS OR WO2005091416/PN)  
 L77 16 SEA FILE=HCAPLUS L25 NOT L76  
 L78 29 DUP REM L77 L48 L55 L61 L75 (3 DUPLICATES REMOVED)

=> d 178 all hitstr 1-29

YOU HAVE REQUESTED DATA FROM FILE 'JAPIO, COMPENDEX, INSPEC, HCAPLUS' - CO  
 NTINUE? (Y)/N:y

L78 ANSWER 1 OF 29 INSPEC (C) 2006 IET on STN  
 AN 2005:8684627 INSPEC  
 TI Experiment and analysis of mass transfer in  
 SrCe0.95Yb0.05O3-a fuel cell using complex  
 impedance plot  
 AU Fukada, S.; Onoda, K.; Suemori, S. (Dept. of Appl. Quantum Phys. &  
 Nucl. Eng., Kyushu Univ., Fukuoka, Japan)  
 SO Journal of Nuclear Science and Technology (March 2005), vol.42,  
 no.3, p. 305-11, 17 refs.

CODEN: JNSTAX, ISSN: 0022-3131

SICI: 0022-3131(200503)42:3L.305:EAMT;1-6

Published by: Atomic Energy Soc. Japan, Japan

DT Journal

TC Experimental; Practical

CY Japan

LA English

AB For the application of proton-conducting ceramics to tritium pumps in nuclear fusion technology, mass-transfer process in a  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a fuel cell was studied experimentally and analytically using complex impedance plot based on an alternate current method. Impedance plots on a complex plane of the  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a fuel cell with the supply of hydrogen and oxygen under a dry or moist condition revealed the presence of a composite imaginary impedance comprised of several mass-or charge-transfer processes as follows: hydrogen or oxygen dissociation on a porous Ni or NiO electrode, hydrogen or oxygen diffusion through the Ni or NiO electrode, reaction of hydrogen and oxygen, and proton diffusion through the ceramic electrolyte. The values of parameters appearing in the mathematical model of their respective mass-transfer and charge-transfer processes were determined independently under different conditions of the hydrogen and oxygen partial pressures, temperature and dry or moist atmosphere. The temperature dependence of the parameters was made clear experimentally, and their physical meaning was discussed. The resistance of the reaction between proton and oxygen ion on the cathode electrode was found to be a key factor

CC A8630G Fuel cells; A2852F Fusion reactor materials; A8230F Ion-molecule, ion-ion, and charge-transfer reactions; A8230L Decomposition reactions (pyrolysis, dissociation, and group ejection); A8245 Electrochemistry and electrophoresis; B8410G Fuel cells

CT ceramics; cerium compounds; charge exchange; diffusion; dissociation; fuel cells; mass transfer; solid electrolytes; strontium compounds; tritium handling

ST proton-conducting ceramics; tritium pumps; nuclear fusion technology; mass-transfer process;  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a fuel cell; complex impedance plot; dry condition; moist condition; composite imaginary impedance; charge-transfer processes; oxygen dissociation; porous Ni; NiO electrode; hydrogen diffusion; oxygen diffusion; proton diffusion; ceramic electrolyte; mathematical model; cathode electrode;  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a

CHI  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$  ss,  $\text{Ce}_{0.95}$  ss,  $\text{Yb}_{0.05}$  ss, Ce ss, Sr ss, Yb ss, O ss

ET  $\text{Ce}^*\text{O}^*\text{Yb}$ ;  $\text{Ce}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a; Ce cp; cp; Yb cp; O cp; O;

$\text{Ce}_{0.95}\text{Yb}_{0.05}\text{O}_3$ ; Ce; Yb; Sr;  $\text{Ce}^*\text{O}^*\text{Sr}^*\text{Yb}$ ; Ce sy 4; sy 4; O sy 4; Sr sy 4; Yb sy 4;  $\text{SrCe}_{0.95}\text{Yb}_{0.05}\text{O}_3$ -a; Sr cp; Ni; Ni\*O; NiO; Ni cp

L78 ANSWER 2 OF 29 INSPEC (C) 2006 IET on STN

AN 2005:8458858 INSPEC DN A2005-15-8630G-012; B2005-07-8410G-089

TI A reverse-current decay mechanism for fuel cells

AU Reiser, C.A.; (UTC Fuel Cells, Connecticut, USA), Bregoli, L.; Patterson, T.W.; Yi, J.S.; Yang, J.D.; Perry, M.L.; Jarvi, T.D.

SO Electrochemical and Solid-State Letters (June 2005), vol.8, no.6, p. A273-6, 8 refs.

CODEN: ESLEF6, ISSN: 1099-0062

SICI: 1099-0062(200506)8:6L.a273:RCDM;1-7

Price: 1099-0062/2005/8(6)/A273/4/\$7.00

Doc.No.: S1099-0062(05)00706-6

Published by: Electrochem. Soc, USA

DT Journal  
 TC Practical; Theoretical  
 CY United States  
 LA English  
 AB A mechanism that may cause accelerated performance decay of fuel cells is presented. The mechanism is explained using a one-dimensional model of the potential profile. The analysis indicates that the electrolyte potential drops from 0 to -0.59 V (vs. RHE) when the anode is partially exposed to hydrogen and partially exposed to oxygen. This causes flow of current opposite to normal fuel cell mode at the oxygen-exposed region and raises the cathode interfacial potential difference to 1.44 V, causing carbon corrosion, which decreases performance. The decay mechanism was validated using two different experimental setups which reproduced the carbon-corrosion phenomenon  
 CC A8630G Fuel cells; A8245 Electrochemistry and electrophoresis; B8410G Fuel cells  
 CT corrosion; electric potential; electrochemical electrodes; proton exchange membrane fuel cells  
 ST reverse-current decay mechanism; fuel cells; one-dimensional model; electrolyte potential profile; anode; current flow; cathode interfacial potential difference; carbon corrosion; 0 to -0.59 V  
 PHP voltage -5.9E-01 to 0.0E+00 V

L78 ANSWER 3 OF 29 COMPENDEX COPYRIGHT 2006 EEI on STN

AN 2005(30):10981 COMPENDEX

TI Electrode development for **reversible solid oxide fuel cells**.

AU Marina, O.A. (Pacific Northwest National Laboratory, Richland, WA, United States); Coffey, G.W.; Pederson, L.R.; Rieke, P.C.; Thomsen, E.C.; Williams, M.C.

MT 2004 Joint International Meeting - 206th Meeting of the Electrochemical Society/2004 Fall Meeting of the Electrochemical Society of Japan, .

ML Honolulu, HI, United States

MD 03 Oct 2004-08 Oct 2004

SO Meeting Abstracts 2004.p 1725

2004 Joint International Meeting - 206th Meeting of the Electrochemical Society/2004 Fall Meeting of the Electrochemical Society of Japan, MA 2004-02  
 ISSN: 1091-8213

PY 2004

MN 65239

DT Conference Article

TC Theoretical

LA English

AB A **reversible solid oxide fuel cell** is capable of generating electricity from hydrogen and hydrocarbon fuels when operating in the normal fuel cell mode (SOFC), and of generating hydrogen from electricity and heat when operated in the **reverse electrolyzer mode (SOEC)**. A **reversible fuel cell** can take advantage of excess electrical grid capacity during off-peak hours to produce hydrogen fuel, to be utilized later during periods of high electrical demand. High temperatures required for SOFC/SOEC operation lead to a lower theoretical decomposition temperature for steam and lower electrode polarization losses compared to those associated with liquid water. Steam electrolysis is an endothermic process and thus can take advantage of waste heat that may be available. This paper discusses the development of anodes and



cathodes for the reversible SOFC. The anode comprises of lanthanum-doped strontium titanate/donor-doped ceria ceramic composites. The cathode is strontium-doped lanthanum ferrite (LSF) and copper-substituted LSF. Electrical, electrocatalytic and thermal properties of both electrodes are studied and presented. In particular, an electrocatalytic activity of electrodes is analyzed using a DC current interrupt technique. It is found that titanate/ceria composite fuel electrodes perform substantially better than Ni/YSZ in the **electrolysis mode**, and the two electrodes perform similarly in the fuel cell mode. Higher operating temperatures result in lower polarization losses for titanate/ceria composite electrodes in both electrolyzer and fuel cell modes. Air electrodes are turned out to be less active in the electrolysis than fuel cell modes. LSF air electrodes typically provide lower overpotential losses in SOFC and SOEC modes than copper-substituted LSF. Changes in the defect chemistry of electrode materials under cathodic and anodic polarization are discussed.

CC 702.2 Fuel Cells; 802.2 Chemical Reactions; 641.1 Thermodynamics; 801.4.1 Electrochemistry; 544.1 Copper

CT \*Solid oxide fuel cells; Polarization; Thermodynamic properties; Decomposition; Copper; Anodic polarization; Electrolysis; Electrodes

ST Steam electrolysis; Lanthanum ferrite (LSF); Ceria composite electrodes; Electrical grids

ET Ni

L78 ANSWER 4 OF 29 COMPENDEX COPYRIGHT 2006 EEI on STN DUPLICATE 1  
AN 2003(12):1897 COMPENDEX

TI Modeling of polymer electrolyte membrane fuel cell with metal foam in the flow-field of the bipolar/end plates.

AU Kumar, Atul (Dept. of Metall./Mat. Engineering University of Alabama, Tuscaloosa, AL 35487, United States); Reddy, R.G.

SO Journal of Power Sources v 114 n 1 Feb 25 2003 2003.p 54-62  
CODEN: JPSODZ ISSN: 0378-7753

PY 2003

DT Journal

TC Theoretical; Experimental

LA English

AB A unified, three-dimensional, steady-state numerical mass-transfer single cell model for polymer electrolyte membrane fuel cell (PEMFC)

was developed. The modeled fuel cell uses metal foam in the flow-field of the bipolar/end plates instead of the conventionally used rectangular channels. Transport equations formulated under the PEMFC conditions were solved using the commercial computational fluid dynamics software Fluent[registered trademark] 6.0 with Gambit [registered trademark] 2.0 as pre-processor. Simulations were performed for different permeability levels of the metal foam in the flow-field. Results showed a significant effect of permeability of the metal foam on the performance of the fuel cell. For example: At 10-6m<sup>2</sup> permeability of metal foam the value of average current density was 5943A/m<sup>2</sup> while at 10-11m<sup>2</sup> permeability, the average current density was 8325A/m<sup>2</sup>. The average current density value for the multi-parallel flow-field channel design (channel width=0.0625in., channel depth=0.0625in. and land width=0.0625in.), which corresponded to an equivalent permeability value of 4.4\*10-8m<sup>2</sup> was 7019A/m<sup>2</sup>. This value for the porous configuration with same permeability and under similar conditions of temperature, pressure and reactants flow rate was slightly lower at 6794A/m<sup>2</sup>. The trend indicated that decreasing the permeability of the flow-field results in better performance from the cell. However, the permeability of



the channel design can not be decreased below the value of around 10-8m<sup>2</sup>, due to difficulty in machining thinner channels. Consequently, the use of metal foam flow-field is proposed in the bipolar/end plate. The developed model offers fuel cell developers a scope for improvement of the bipolar/end plates in the fuel cell, by switching over to the metal foam flow-field concept. \$CPY 2002 Elsevier Science B.V. All rights reserved. 15 Refs.

CC 702.2 Fuel Cells; 817.1 Plastics Products; 802.1 Chemical Plants and Equipment; 803 Chemical Agents; 804 Chemical Products Generally; 641.3 Mass Transfer  
 CT \*Fuel cells; Mass transfer; Computational fluid dynamics; Electrolytes; Transport properties; Computer simulation; Current density; Polymeric membranes  
 ST Bipolar plates  
 ET At

L78 ANSWER 5 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 2001:299255 HCAPLUS

DN 134:329048

ED Entered STN: 27 Apr 2001

TI Preparation of electrode catalyst layers containing hydrogen ion-conductive polymer matrixes used for polymer electrolyte fuel cells

IN Wakita, Hidenobu; Hosaka, Masahito; Hori, Yoshihiro; Uchida, Makoto; Yasumoto, Eiichi; Kanbara, Teruhisa

PA Matsushita Electric Industrial Co., Ltd., Japan

SO Jpn. Kokai Tokkyo Koho, 8 pp.

CODEN: JKXXAF

DT Patent

LA Japanese

IC ICM H01M004-88

ICS H01M004-92; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 37, 38

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2001118579	A2	20010427	JP 1999-293867	19991015

PRAI JP 1999-293867

19991015 <--

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 2001118579	ICM	H01M004-88
	ICS	H01M004-92; H01M008-10
	IPCI	H01M0004-88 [ICM,7]; H01M0004-92 [ICS,7]; H01M0008-10 [ICS,7]
	IPCR	H01M0004-88 [I,A]; H01M0004-88 [I,C]; H01M0008-10 [I,A]; H01M0008-10 [I,C]

AB The electrode catalyst layers are prepd. by (1) prepg. catalyst compns. contg. noble metal ions and H<sup>+</sup>-conductive macromol. electrolytes, (2) applying the compns. onto H<sup>+</sup>-conductive electrolyte films or gas-diffusion layers, and (3) reducing the noble metal ions. Alternatively, the H<sup>+</sup>-conductive macromol. electrolyte films or gas-diffusion layers

are soaked in the catalyst compns. instead of (2). Preferably, aq. HNO<sub>3</sub> solns. contg. diamminedinitroplatinum, tetraamminedi-hydroxoplatinum, or hexahydroxoplatinic acid are used as the catalyst compns. Preferably, perfluorosulfonate ionomers are used as the H<sup>+</sup>-conductive macromol. electrolytes. Since the prep'd. catalyst layers are free from catalyst supports and the catalysts are directly bonded with elec. conductive agents (i.e., carbon black, graphite) which are included in the catalyst compns., only a small amt. of the catalysts are needed.

- ST **fuel cell** electrode catalyst layer manuf;  
hydrogen ion conductive polymer electrode **fuel**  
**cell**; perfluorosulfonate ionomer electrode **fuel**  
**cell**; polymer electrolyte **fuel cell**  
electrode manuf; platinum catalyst electrode layer **fuel**  
**cell**; redn catalyst ion **fuel cell**  
electrode
- IT Cation exchange  
(H<sup>+</sup>-conductive polymer; prepn. of electrode catalyst layers  
contg. H<sup>+</sup>-conductive polymer matrixes used for polymer  
electrolyte **fuel cells**)
- IT Ionomers  
RL: DEV (Device component use); PEP (Physical, engineering or  
chemical process); PROC (Process); USES (Uses)  
(H<sup>+</sup>-conductive; prepn. of electrode catalyst layers contg.  
H<sup>+</sup>-conductive polymer matrixes used for polymer electrolyte  
**fuel cells**)
- IT Reduction  
(catalyst precursors; prepn. of electrode catalyst layers contg.  
H<sup>+</sup>-conductive polymer matrixes used for polymer electrolyte  
**fuel cells**)
- IT Precious metals  
RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP  
(Preparation); USES (Uses)  
(catalysts; prepn. of electrode catalyst layers contg.  
H<sup>+</sup>-conductive polymer matrixes used for polymer electrolyte  
**fuel cells**)
- IT 75634-46-7, Flemion  
RL: DEV (Device component use); PEP (Physical, engineering or  
chemical process); PROC (Process); USES (Uses)  
(H<sup>+</sup>-conductive polymer matrixes; prepn. of electrode catalyst  
layers contg. H<sup>+</sup>-conductive polymer matrixes used for polymer  
electrolyte **fuel cells**)
- IT 12408-02-5, Hydrogen ion, uses  
RL: TEM (Technical or engineered material use); USES (Uses)  
(H<sup>+</sup>-conductive polymer; prepn. of electrode catalyst layers  
contg. H<sup>+</sup>-conductive polymer matrixes used for polymer  
electrolyte **fuel cells**)
- IT 14286-02-3, Diamminedinitroplatinum 15651-37-3,  
Tetraammineplatinum dihydroxide 16941-12-1, Chloroplatinic acid  
51850-20-5  
RL: PEP (Physical, engineering or chemical process); PROC (Process)  
(catalyst precursor; prepn. of electrode catalyst layers contg.  
H<sup>+</sup>-conductive polymer matrixes used for polymer electrolyte  
**fuel cells**)
- IT 7440-06-4P, Platinum, uses  
RL: CAT (Catalyst use); IMF (Industrial manufacture); PREP  
(Preparation); USES (Uses)  
(catalyst; prepn. of electrode catalyst layers contg.  
H<sup>+</sup>-conductive polymer matrixes used for polymer electrolyte  
**fuel cells**)

IT 1310-73-2, Sodium hydroxide, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(cation exchange of H+-conductive polymer with alkali metals;  
prepn. of electrode catalyst layers contg. H+-conductive polymer  
matrixes used for polymer electrolyte fuel  
cells)

IT 7664-93-9, Sulfuric acid, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(cation exchange of alkali metal-contg. H+-conductive polymer;  
prepn. of electrode catalyst layers contg. H+-conductive polymer  
matrixes used for polymer electrolyte fuel  
cells)

IT 7440-44-0, Carbon, uses  
RL: DEV (Device component use); USES (Uses)  
(paper, gas-diffusion layer; prepn. of electrode catalyst layers  
contg. H+-conductive polymer matrixes used for polymer  
electrolyte fuel cells)

IT 50-00-0, Formaldehyde, uses 302-01-2, Hydrazine, uses 1333-74-0,  
Hydrogen, uses 7727-37-9, Nitrogen, uses  
RL: NUU (Other use, unclassified); USES (Uses)  
(reducing agent for catalyst precursor; prepn. of electrode  
catalyst layers contg. H+-conductive polymer matrixes used for  
polymer electrolyte fuel cells)

L78 ANSWER 6 OF 29 HCAPLUS . COPYRIGHT 2006 ACS on STN

AN 2001:729935 HCAPLUS

DN 135:275374

ED Entered STN: 05 Oct 2001

TI Fuel cell and fuel cell device

IN Yamamoto, Taizo; Kobayashi, Masafumi; Yamana, Kenji; Kato, Hidemi

PA Equos Research Co., Ltd., Japan

SO Eur. Pat. Appl., 22 pp.

CODEN: EPXXDW

DT Patent

LA English

IC ICM H01M008-10

ICS H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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PI EP 1139476	A2	20011004	EP 2001-107720	200103 30
			<--	
EP 1139476	A3	20040421		
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO				
JP 2001283875	A2	20011012	JP 2000-98419	200003 31
			<--	
US 2001041282	A1	20011115	US 2001-821733	200103 30
			<--	
US 6797426	B2	20040928		
CA 2342747	AA	20010930	CA 2001-2342747	200104

02

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PRAI JP 2000-98419            A            20000331    <--

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
EP 1139476	ICM	H01M008-10
	ICS	H01M008-04
	IPCI	H01M0008-10 [ICM,6]; H01M0008-04 [ICS,6]
	IPCR	H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-10 [I,A]; H01M0008-10 [I,C]
	ECLA	H01M008/04C2E; H01M008/10B
JP 2001283875	IPCI	H01M0008-02 [ICM,7]; H01M0004-96 [ICS,7]; H01M0008-04 [ICS,7]; H01M0008-10 [ICS,7]
	IPCR	H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-10 [I,A]; H01M0008-10 [I,C]
US 2001041282	IPCI	H01M0004-86 [ICM,7]
	IPCR	H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-10 [I,A]; H01M0008-10 [I,C]
	NCL	429/040.000
	ECLA	H01M008/04C2E; H01M008/10B
CA 2342747	IPCI	H01M0008-00 [ICM,7]; H01M0008-04 [ICS,7]
	IPCR	H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-10 [I,A]; H01M0008-10 [I,C]

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AB A fuel cell comprises a fuel electrode which has a **fuel-diffusion layer** for diffusing fuel and a fuel-reactive layer for having the fuel react; an oxygen electrode which has an **oxygen-diffusion layer** for diffusing oxygen and an oxygen-reactive layer for having the oxygen react; an electrolyte layer which is arranged between the fuel electrode and the oxygen electrode. In this fuel cell, the fuel-reactive layer is in contact with the **fuel-diffusion layer**, and the **oxygen-reactive layer** is in contact with the **oxygen-diffusion layer**. Further, the **fuel-diffusion layer** has higher water-repellency than that of the **oxygen-diffusion layer**. According to this fuel cell, cell outputs of fuel cells can be enhanced. Thus, fuel cells and fuel cell devices, which bring high cell outputs, can be provided.

ST fuel cell

IT Carbon fibers, uses

RL: DEV (Device component use); USES (Uses)  
(fabrics; fuel cell with **fuel-diffusion layer** of higher water-repellency than that of **oxygen-diffusion layer**)

IT Polyoxyalkylenes, uses

RL: TEM (Technical or engineered material use); USES (Uses)  
(fluorine- and sulfo-contg., ionomers; fuel cell with **fuel-diffusion layer** of higher water-repellency than that of **oxygen-diffusion layer**)

IT Fuel cells

(fuel cell with **fuel-diffusion layer** of higher water-repellency than that of **oxygen-diffusion layer**)

IT Carbon black, uses  
RL: DEV (Device component use); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

IT Fluoropolymers, uses  
RL: TEM (Technical or engineered material use); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

IT Fluoropolymers, uses  
RL: TEM (Technical or engineered material use); USES (Uses)  
(polyoxyalkylene-, sulfo-contg., ionomers; fuel cell with  
**fuel-diffusion layer** of higher  
water-repellency than that of **oxygen-diffusion**  
**layer**)

IT Ionomers  
RL: TEM (Technical or engineered material use); USES (Uses)  
(polyoxyalkylenes, fluorine- and sulfo-contg.; fuel cell with  
**fuel-diffusion layer** of higher  
water-repellency than that of **oxygen-diffusion**  
**layer**)

IT 7440-06-4, PLatinum, uses  
RL: CAT (Catalyst use); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

IT 7440-44-0, Carbon, uses  
RL: DEV (Device component use); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

IT 7782-44-7, Oxygen, uses  
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT  
(Reactant or reagent); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

IT 1333-74-0, Hydrogen, uses 9002-84-0, Ptfе 163294-14-2, nafion  
112  
RL: TEM (Technical or engineered material use); USES (Uses)  
(fuel cell with **fuel-diffusion layer**  
of higher water-repellency than that of **oxygen-**  
**diffusion layer**)

L78 ANSWER 7 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN DUPLICATE 2  
AN 2000:595218 HCAPLUS  
DN 133:166159  
ED Entered STN: 27 Aug 2000  
TI Electrochemical performance of a multi-tubular fuel cell and  
electrolyzer array  
AU Kimble, Michael C.; Anderson, Everett B.; Jayne, Karen D.; Woodman,  
Alan S.; Legner, Hartmut H.  
CS Physical Sciences Inc., Andover, MA, 01810, USA  
SO Proceedings of the Intersociety Energy Conversion Engineering  
Conference (2000), 35th(Vol. 1), 428-433  
CODEN: PIECDE; ISSN: 0146-955X  
PB Society of Automotive Engineers  
DT Journal  
LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 Section cross-reference(s): 72

AB Miniaturization of tubular membrane and electrode assemblies (MEAs)  
 allows compact fuel cells and electrolyzers to be developed with  
 power d. projections of 6 kW/L and 11 kW/kg. These tubular MEAs  
 have been assembled into multitube arrays and connected in either  
 serial or parallel arrangements. Pressure testing and leak testing  
 of these arrays has shown no signs of leakage indicating the  
 viability of assembling these tubes into electrochem. stacks. The  
 tubular MEAs in these arrays have been studied by assessing the  
 electrochem. performance of each tubular MEA in the stack. These  
 investigations have indicated no significant performance issues  
 between the interior and exterior tubes in the array. The operation  
 of these tubular MEA arrays in the electrolysis mode supports the  
 use of these miniaturized tubes for a **reversible  
 fuel cell and electrolyzer  
 energy storage system.**

ST fuel cell multitubular array performance; electrolyzer multitubular  
 array performance

IT Electrolytic cells  
 Fuel cells  
 (electrochem. performance of multitubular fuel cell and  
 electrolyzer array)

RE.CNT 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR THIS RECORD  
 RE

(1) Kimble, M; Proceedings of the 34th Intersociety Energy Conversion  
 Engineering Conference 1999

(2) Kimble, M; SAE Aerospace Power Systems Conference 1999, 1999-01-1371,  
 P75

(3) Kimble, M; The Electrochemical Society Fall Meeting 1999

L78 ANSWER 8 OF 29 COMPENDEX COPYRIGHT 2006 EEI on STN

AN 2000(52):3857 COMPENDEX

TI Electrochemical performance of a multi-tubular fuel cell and  
 electrolyzer array.

AU Kimble, Michael C. (Physical Sciences Inc, Andover, MA, USA);  
 Anderson, Everett B.; Jayne, Karen D.; Woodman, Alan S.; Legner,  
 Hartmut H.

MT 35th Intersociety Energy Conversion Engineering Conference.

ML Las Vegas, NV, USA

MD 24 Jul 2000-28 Jul 2000

SO Proceedings of the Intersociety Energy Conversion Engineering  
 Conference v 1 2000.IEEE, Piscataway, NJ, USA,00CB37022.p 428-433  
 CODEN: PIECDE ISSN: 0146-955X

PY 2000

MN 57519

DT Conference Article

TC Theoretical

LA English

AB Miniaturization of tubular membrane and electrode assemblies (MEAs)  
 allows compact fuel cells and electrolyzers to be developed with  
 power density projections of 6 kW/liter and 11 kW/kg. These tubular  
 MEAs have been assembled into multi-tube arrays and connected in  
 either serial or parallel arrangements. Pressure testing and leak  
 testing of these arrays has shown no signs of leakage indicating the  
 viability of assembling these tubes into electrochemical stacks. The  
 tubular MEAs in these arrays have been studied by assessing the  
 electrochemical performance of each tubular MEA in the stack. These  
 investigations have indicated no significant performance issues  
 between the interior and exterior tubes in the array. The operation



of these tubular MEA arrays in the **electrolysis**  
**mode** supports the use of these miniaturized tubes for a  
**reversible fuel cell** and electrolyzer  
energy storage system. (Author abstract) 3 Refs.

CC 702.2 Fuel Cells; 801.4.1 Electrochemistry; 619.1 Pipe, Piping and  
Pipelines; 525.7 Energy Storage; 704.1 Electric Components  
CT \*Fuel cells; Electrochemical electrodes; Arrays; Tubes (components);  
Pressure; Energy storage; Cathodes; Electrolysis  
ST Tubular membrane and electrode assembly; Electrolyzer array;  
Multitube arrays

L78 ANSWER 9 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1999:77083 HCAPLUS

DN 130:184792

ED Entered STN: 05 Feb 1999

TI Multicomponent transport in porous electrodes of proton exchange  
membrane **fuel cells** using the interdigitated gas  
distributors

AU Yi, Jung Seok; Van Nguyen, Trung

CS Department of Chemical and Petroleum Engineering, University of  
Kansas, Lawrence, KS, 66045, USA

SO Journal of the Electrochemical Society (1999), 146(1), 38-45  
CODEN: JESOAN; ISSN: 0013-4651

PB Electrochemical Society

DT Journal

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

AB Hydrodynamics of gases in the cathode of a proton exchange membrane  
**fuel cell** that is contacted to an interdigitated  
gas distributor are investigated using a steady-state multicomponent  
transport model. The model describes the two-dimensional flow  
patterns and the distributions of the gaseous species in the porous  
electrode and predicts the c.d. generated at the electrode and  
membrane interface as a function of various operating conditions and  
design parameters. Results from the model show that, with the  
forced flow-through condition created by the interdigitated gas  
distributor design, the diffusion layer is  
greatly reduced. However, even with a much thinner  
diffusion layer, diffusion still plays a significant role in the  
transport of oxygen to the reaction surface. The results also show  
that the av. c.d. generated at an air cathode increases with higher  
gas flow-through rates, thinner electrodes, and narrower shoulder  
widths between the inlet and outlet channels of the interdigitated  
gas distributor.

ST proton exchange membrane **fuel cell** cathode;  
multicomponent transport porous electrode **fuel**  
**cell**

IT **Fuel cell** cathodes

**Fuel cells**

Hydrodynamics

Simulation and Modeling, physicochemical

(multicomponent transport in porous electrodes of proton exchange  
membrane **fuel cells** using interdigitated gas  
distributors)

IT Flow

(two-dimensional; multicomponent transport in porous electrodes  
of proton exchange membrane **fuel cells** using  
interdigitated gas distributors)

RE.CNT 18 THERE ARE 18 CITED REFERENCES AVAILABLE FOR THIS RECORD

RE

- (1) Bear, J; Modeling and Application of Transport Phenomena in Porous Media 1991
- (2) Bird, R; Transport Phenomena 1960
- (3) Blomen, J; Fuel Cell Systems 1993
- (4) Cussler, E; Diffusion: Mass Transport in Fluid Systems 1984
- (5) Nguyen, T; Comput Chem Eng 1987, V11, P543 HCAPLUS
- (6) Nguyen, T; J Electrochem Soc 1993, V140, P2178 HCAPLUS
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- (9) Raistrick, I; US 4826115 1989
- (10) Ticianelli, E; J Electrochem Soc 1988, V135, P2209 HCAPLUS
- (11) Vanderborgh, N; Paper presented at 25th IECEC 1990
- (12) Washington, K; US 5300370 1994
- (13) Watanabe, M; J Electrochem Soc 1993, V140, P3190 HCAPLUS
- (14) Wilson, M; Electrochim Acta 1995, V40, P355 HCAPLUS
- (15) Wood, D; Electrochim Acta 1998, V43, P3795 HCAPLUS
- (16) Yi, J; J Electrochem Soc 1998, V145, P1149 HCAPLUS
- (17) Yi, J; Proton Conducting Membrane Fuel Cells I, The Electrochemical Society Proceeding Series 1995, PV 95-23, P115
- (18) Yi, J; The Electrochemical Society Meeting Abstracts 1996, V96-2, P974

L78 ANSWER 10 OF 29 INSPEC (C) 2006 IET on STN  
 AN 1999:6299637 INSPEC DN A1999-16-8630G-002; B1999-08-8410G-020  
 TI Investigations on the kinetics of the oxygen reduction in high temperature fuel cells  
 AU Erning, J.W.  
 CS Forschungszentrum Julich, Germany  
 NR JUL-3561  
 SO July 1998, 145 pp., 74 refs.  
 AV TIB Hannover, D-30167 Hannover, Germany  
 DT Report  
 TC Experimental; Practical  
 CY Germany  
 LA German  
 AB Lanthanum-strontium-manganite perovskites are the most widespread materials in use for solid oxide fuel cell (SOFC) cathodes. The electrode reaction taking place, i.e. the reduction of oxygen supplied by air, was investigated by electrochemical means to obtain further knowledge about the electrode processes. The high activation energy of this reaction (200 kJ/mol), preventing lower operation temperatures of the SOFC, was the starting point for the investigation. Quasi steady state current voltage measurements and impedance spectroscopy were performed in a three electrode configuration. The electrodes were of circular shape with a diameter of 10 mm. The preparation was made by screen printing as well as wet powder spraying onto plates made of yttria-stabilized zirconia. Perovskite powders of varying chemical and stoichiometric composition were used. To obtain higher power densities and, more important, lower apparent activation energies, catalytic layers were added at the interface electrode/electrolyte. Additionally, a less complex system, a model electrode/electrolyte setup made from single-crystal YSZ as electrolyte and gold in liquid and solid state as electrode was developed to create a better defined system. This setup was used to investigate the behaviour of the electrode/electrolyte interface. Reliable, reproducible results could be obtained using either setup. The experimental conditions i.e. oxygen partial pressure, temperature and overpotential were varied in order to determine the kinetic properties of the electrodes. Apparent activation energies,

pre-exponential factors, apparent charge-transfer coefficients and electrochemical orders of reaction were calculated from the current-voltage data in order to propose possible reaction steps

CC A8630G Fuel cells; A0130Q Reports, dissertations, theses; A8245 Electrochemistry and electrophoresis; B8410G Fuel cells

CT electrochemical electrodes; electrochemistry; lanthanum compounds; powder technology; reduction (chemical); solid electrolytes; solid oxide fuel cells; strontium compounds

ST perovskite powders; SOFC; oxygen reduction kinetics; electrode processes; impedance spectroscopy; I-V characteristic; powder technology; activation energy dependence; catalytic layer addition; electrode electrolyte interface; YSZ electrolyte; oxygen partial pressure dependence; temperature dependence; overpotential dependence; solid oxide fuel cell cathodes; charge-transfer coefficients; 800 to 950 C; ZrO<sub>2</sub>-Y<sub>2</sub>O<sub>3</sub>; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Pd; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Pt; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Ir; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Ru; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.1</sub>Mn<sub>0.9</sub>O<sub>3</sub>; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>:Pd; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>:Pd-Pt; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Pd-Pt; La<sub>0.65</sub>Sr<sub>0.3</sub>MnO<sub>3</sub>:Y<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub>

CHI ZrO<sub>2</sub>Y<sub>2</sub>O<sub>3</sub> ss, O<sub>2</sub> ss, O<sub>3</sub> ss, Y<sub>2</sub> ss, Zr ss, O ss, Y ss; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, La ss, Mn ss, O<sub>3</sub> ss, Sr ss, O ss; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Pd ss, La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, La ss, Mn ss, O<sub>3</sub> ss, Pd ss, Sr ss, O ss, Pd el, Pd dop; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Pt ss, La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, La ss, Mn ss, O<sub>3</sub> ss, Pt ss, Sr ss, O ss, Pt el, Pt dop; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Ir ss, La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, Ir ss, La ss, Mn ss, O<sub>3</sub> ss, Sr ss, O ss, Ir el, Ir dop; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:Ru ss, La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, La ss, Mn ss, O<sub>3</sub> ss, Ru ss, Sr ss, O ss, Ru el, Ru dop; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.1</sub>Mn<sub>0.9</sub>O<sub>3</sub> ss, La<sub>0.79</sub> ss, Sr<sub>0.16</sub> ss, Co<sub>0.1</sub> ss, Mn<sub>0.9</sub> ss, Co ss, La ss, Mn ss, O<sub>3</sub> ss, Sr ss, O ss; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub> ss, La<sub>0.79</sub> ss, Sr<sub>0.16</sub> ss, Co<sub>0.2</sub> ss, Mn<sub>0.8</sub> ss, Co ss, La ss, Mn ss, O<sub>3</sub> ss, Sr ss, O ss; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>:Pd ss, La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub> ss, La<sub>0.79</sub> ss, Sr<sub>0.16</sub> ss, Co<sub>0.2</sub> ss, Mn<sub>0.8</sub> ss, Co ss, La ss, Mn ss, O<sub>3</sub> ss, Pd ss, Sr ss, O ss, Pd el, Pd dop; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>:PdPt ss, La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub> ss, La<sub>0.79</sub> ss, Sr<sub>0.16</sub> ss, Co<sub>0.2</sub> ss, Mn<sub>0.8</sub> ss, PdPt ss, Co ss, La ss, Mn ss, O<sub>3</sub> ss, Pd ss, Pt ss, Sr ss, O ss, PdPt dop, Pd dop, Pt dop; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub>:PdPt ss, La<sub>0.84</sub>Sr<sub>0.16</sub>MnO<sub>3</sub> ss, La<sub>0.84</sub> ss, Sr<sub>0.16</sub> ss, PdPt ss, La ss, Mn ss, O<sub>3</sub> ss, Pd ss, Pt ss, Sr ss, O ss, PdPt dop, Pd dop, Pt dop; La<sub>0.65</sub>Sr<sub>0.3</sub>MnO<sub>3</sub>:Y<sub>2</sub>O<sub>3</sub>ZrO<sub>2</sub> ss, La<sub>0.65</sub>Sr<sub>0.3</sub>MnO<sub>3</sub> ss, Y<sub>2</sub>O<sub>3</sub>ZrO<sub>2</sub> ss, La<sub>0.65</sub> ss, Sr<sub>0.3</sub> ss, La ss, Mn ss, O<sub>2</sub> ss, O<sub>3</sub> ss, Sr ss, Y<sub>2</sub> ss, Zr ss, O ss, Y ss, Y<sub>2</sub>O<sub>3</sub>ZrO<sub>2</sub> dop, O<sub>2</sub> dop, O<sub>3</sub> dop, Y<sub>2</sub> dop, Zr dop, O dop, Y dop

PHP temperature 1.07E+03 to 1.22E+03 K

ET V; O\*Y; Y<sub>2</sub>O<sub>3</sub>; Y cp; cp; O cp; O<sub>2</sub>-Y<sub>2</sub>O<sub>3</sub>; Mn\*O\*Sr; Mn sy 3; sy 3; O sy 3; Sr sy 3; Sr<sub>0.16</sub>MnO<sub>3</sub>; Sr cp; Mn cp; Mn\*O\*Pd\*Sr; Mn sy 4; sy 4; O sy 4; Pd sy 4; Sr sy 4; Sr<sub>0.16</sub>MnO<sub>3</sub>:Pd; Pd doping; doped materials; Ir\*Mn\*O\*Sr; Ir sy 4; Sr<sub>0.16</sub>MnO<sub>3</sub>:Ir; Ir doping; Mn\*O\*Ru\*Sr; Ru sy 4; Sr<sub>0.16</sub>MnO<sub>3</sub>:Ru; Ru doping; Co\*Mn\*O\*Sr; Co sy 4; Sr<sub>0.16</sub>Co<sub>0.1</sub>Mn<sub>0.9</sub>O<sub>3</sub>; Co cp; Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>; Co\*Mn\*O\*Pd\*Sr; Co sy 5; sy 5; Mn sy 5; O sy 5; Pd sy 5; Sr sy 5; Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O<sub>3</sub>:Pd; Mn\*O\*Sr\*Y\*Zr; Y sy 5; Zr sy 5; Sr<sub>0.3</sub>MnO<sub>3</sub>:Y<sub>2</sub>O<sub>3</sub>; Y<sub>2</sub>O<sub>3</sub> doping; ZrO<sub>2</sub>; Zr cp; Sr<sub>0.3</sub>MnO<sub>3</sub>:Y<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub>; O<sub>2</sub>Y<sub>2</sub>O; O; Y; Zr; Sr<sub>0.16</sub>MnO; La; Sr; Mn; Pd; La\*Mn\*O\*Sr; La sy 4; La<sub>0.84</sub>Sr<sub>0.16</sub>MnO; La cp; Pt; Ir; Ru; Sr<sub>0.16</sub>Co<sub>0.1</sub>Mn<sub>0.9</sub>O; Co; Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O; Co\*La\*Mn\*O\*Sr; La sy 5; La<sub>0.79</sub>Sr<sub>0.16</sub>Co<sub>0.2</sub>Mn<sub>0.8</sub>O; Pd\*Pt; Pd sy 2; sy 2; Pt sy 2; PdPt; Pd cp; Pt cp; Sr<sub>0.3</sub>MnO; O\*Y\*Zr; Y sy 3; Zr sy 3; Y<sub>2</sub>O<sub>3</sub>ZrO;

La0.65Sr0.3MnO

L78 ANSWER 11 OF 29 JAPIO (C) 2006 JPO on STN

AN 1998-259765 JAPIO

TI INTERNAL PRESSURE CONTROL DEVICE FOR FUEL TANK AND TANK INTERNAL PRESSURE CONTROL VALVE

IN ITAKURA HIDEAKI; KATO NAOYA; YOSHINAGA TORU; AZEGAMI KATSUO; MAEDA KAZUTO; KOYAMA NOBUHIKO

PA NIPPON SOKEN INC  
DENSO CORP

PI JP 10259765 A 19980929 Heisei

AI JP 1997-145411 (JP09145411 Heisei) 19970603

PRAI JP 1997-6564 19970117

SO PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1998

IC ICM F02M025-08

ICS F02M037-00

AB PROBLEM TO BE SOLVED: To control diffusion of evaporated fuel in a canister during the decrease of fuel temperature when an engine is stopped and prevent the occurrence of a trouble, such as blow-by of evaporated fuel.

SOLUTION: A canister 10 is connected to a fuel tank 5 through a first evaporation passage 8 and a tank internal pressure regulation valve 11 is disposed in the evaporation passage 8. An atmosphere port 13 to introduce outside air is formed in the canister 10 and an electromagnetically-driven atmosphere intake valve 14 is disposed at the tip part of the atmosphere port 13. An ECU 20 controls opening and closing operation of the atmosphere intake valve 14 so that an internal pressure in a tank is fluctuated with a given width in a negative pressure region during the decrease of fuel temperature when an engine is stopped. In this case, through opening of the atmosphere intake valve 14, high speed outside air flows in the canister 10 and this constitution performs back purge of evaporated fuel and narrows an evaporated fuel diffusion layer in the canister 10.

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L78 ANSWER 12 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1997:659512 HCAPLUS

DN 127:320895

ED Entered STN: 17 Oct 1997

TI Use of excess solar array power by regenerative fuel cell energy storage systems in low Earth orbit

AU Hoberecht, Mark A.; Green, Robert D.

CS Lewis Research Center, National Aeronautics Space Administration, Cleveland, OH, 44135, USA

SO Proceedings of the Intersociety Energy Conversion Engineering Conference (1997), 32nd, 224-227

CODEN: PIECDE; ISSN: 0146-955X

PB Society of Automotive Engineers

DT Journal

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

AB Regenerative fuel cells (RFC's) are a competing energy storage system technol. for a no. of low-earth-orbit applications. The system is comprised of an electrolyzer which utilizes solar array power to convert water into hydrogen and oxygen reactants, a fuel cell that recombines the reactants back into water and produces power during eclipse, and assocd. controls and reactant storage. Round-trip



elec. efficiencies of RFC systems are typically lower than competing battery **energy storage** systems. This results in larger solar arrays for the same application, with inherent drag, mass, and cost penalties. However, the increase in solar array size can be limited, if not totally eliminated, because of the ability of RFC systems to use excess solar array power. With a RFC system, any excess solar array power can be converted directly into reactants. In some cases the quantity of reactants can be significant. This is in addn. to the normal quantity of reactants produced during the insolation (sunlit) portion of a typical orbital cycle. Assuming sufficiently sized reactant storage tanks, the addnl. reactants can be used to reduce the required input power for all orbital cycles throughout the year, effectively reducing the required size of the solar array. With battery **energy storage** systems, excess solar array power is typically shunted and not utilized. For this paper, the International Space Station (ISS) application was chosen for evaluation and comparison of battery and RFC **energy storage** systems. This selection was based on the authors' familiarity with the ISS design and the availability of a detailed inhouse computer model specific to the ISS elec. power system (SPACE). Combined altitude and orientation effects, seasonal variations, and beginning-of-life solar array performance were examd. for individual orbits at and above specified ref. points. Charging characteristics of the battery system were also investigated. The evaluation allowed a comparison of the solar array size required with the existing battery **energy storage** system to the projected solar array size required with a possible RFC system. The results of the examn. indicated that no increase in solar array size would be necessary for the ISS if outfitted with a RFC **energy storage** system, in spite of the lower round-trip elec. efficiency. For orbits with a min. of excess power, the battery **energy storage** system used only 73% of the available solar array power as compared to 100% usage for a RFC system. The usage by the battery system was far less for the orbits with higher amts. of excess power. In terms of solar array size, a 59% efficient RFC system thus becomes equiv. to an 80% efficient battery system. Thus, for the ISS and possibly other low-earth-orbit spacecraft, there would be little if any solar array size advantage as a result of a difference in round-trip elec. efficiency between battery and RFC **energy storage** systems.

ST regenerative fuel cell **energy storage**  
spacecraft; solar cell array power fuel cell

IT Fuel cells  
(regenerative fuel cells; use of excess solar array power by  
regenerative fuel cell **energy storage** systems  
in low Earth orbit)

IT Solar cells  
Solar power  
(use of excess solar array power by regenerative fuel cell  
**energy storage** systems in low Earth orbit)

RE.CNT 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR THIS RECORD  
RE

- (1) Fincannon, J; Proceedings, 31st Intersociety Energy Conversion Engineering Conference 1996
- (2) Hojnicky, J; Proceedings, 28th Intersociety Energy Conversion Engineering Conference 1993
- (3) Manzo, M; Proceedings, 19th Intersociety Energy Conversion Engineering Conference 1984



L78 ANSWER 13 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 1995:748782 HCAPLUS  
 DN 123:118528  
 ED Entered STN: 22 Aug 1995  
 TI Polymer electrolyte **fuel cells** maintaining  
 constant water content  
 IN Haga, Tetsuya; Asaoka, Masahiko; Suzuki, Takanao; Kawahara, Kazuo;  
 Abe, Katsuji  
 PA Toyoda Chuo Kenkyusho Kk, Japan  
 SO Jpn. Kokai Tokkyo Koho, 5 pp.  
 CODEN: JKXXAF  
 DT **Patent**  
 LA Japanese  
 IC ICM H01M004-86  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 FAN.CNT 1

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 07134993	A2	19950523	JP 1993-279957	19931109

JP 3331703 B2 20021007  
 PRAI JP 1993-279957 19931109 <--

## CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
JP 07134993	ICM	H01M004-86
	IPCI	H01M0004-86 [ICM,6]

AB The **fuel cells** consist of a solid polymer membrane, a fuel electrode, and an air electrode, and both electrodes have a catalyst layer in contact with the membrane, and a gas diffusion layer increasingly hydrophobic with distance from (for fuel electrode) or toward (for air electrode) the catalyst layer. Gas **diffusion layers** with **tapering** hydrophobic ability were prepd. from mixts. of powd. C and PTFE of varying wt. ratio.  
 ST polymer electrolyte **fuel cell**  
 IT Electrodes  
 (fuel-cell, with tapering hydrophobic ability for retention of water)  
 IT 7440-44-0, Carbon, uses 9002-84-0, PTFE  
 RL: TEM (Technical or engineered material use); USES (Uses)  
 (powd., gas diffusion layer component; **fuel cells** with tapering hydrophobic ability for retention of water)

L78 ANSWER 14 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
 AN 1995:840984 HCAPLUS  
 DN 123:233317  
 ED Entered STN: 07 Oct 1995  
 TI Development of Mitsubishi-planar reversible cell-fundamental test on hydrogen-utilized electric power storage system  
 AU Kusunoki, D.; Kikuoka, Y.; Yanagi, V.; Kugimiya, K.; Yoshino, M.; Tokura, M.; Watanabe, K.; Miyamoto, H.; Ueda, S.; et al.  
 CS Kansai Electric Power Company, Osaka, Japan  
 SO International Journal of Hydrogen Energy (1995), 20(10), 831-4  
 CODEN: IJHEDX; ISSN: 0360-3199

PB Elsevier  
 DT Journal  
 LA English  
 CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
 AB This paper presents a fundamental test facility on hydrogen-utilized elec. power storage system. The system takes advantage of a **reversibility** of solid **electrolyte** as a **fuel cell** and as an electrolysis cell. The test facility, which is equipped with a 0.075 m square reversible cell, was installed and characteristics for reverse cell conditions were evaluated. These results demonstrate applicability of our cell for the **energy storage** system and we discuss some tech. subjects to be solved.  
 ST fuel cell test facility; hydrogen utilized elec power storage system  
 IT **Fuel cells**  
 (solid electrolyte; development of Mitsubishi-planar **reversible** cell-fundamental test on hydrogen-utilized elec. power storage system)

L78 ANSWER 15 OF 29 COMPENDEX COPYRIGHT 2006 EEI on STN DUPLICATE 3  
 AN 1994(43):1890 COMPENDEX  
 TI Proton-exchange membrane regenerative fuel cells.  
 AU Swette, Larry L. (Giner, Inc, Waltham, MA, USA); LaConti, Anthony B.; McCatty, Stephen A.  
 MT Proceedings of the 4th Space Electrochemical Research and Technology Conference.  
 ML Cleveland, OH, USA  
 MD 14 Apr 1993-15 Apr 1993  
 SO Journal of Power Sources v 47 n 3 Jan 15 1994.p 343-351  
 CODEN: JPSODZ ISSN: 0378-7753  
 PY 1994  
 MN 20355  
 DT Journal  
 TC General Review; Experimental  
 LA English  
 AB This paper will update the progress in developing electrocatalyst systems and electrode structures primarily for the positive electrode of single-unit solid polymer proton-exchange membrane (PEM) regenerative fuel cells. The work was done with DuPont Nafion 117 in complete **fuel cells** (40 cm<sup>2</sup> electrodes). The cells were operated **alternately** in **fuel cell mode** and **electrolysis mode** at 80 degree C. In fuel cell mode, humidified hydrogen and oxygen were supplied at 207 kPa (30 psi); in **electrolysis mode**, water was pumped over the positive electrode and the gases were evolved at ambient pressure. Cycling data will be presented for Pt-Ir catalysts and limited bifunctional data will be presented for Pt, Ir, Ru, Rh and NaxPt3O4 catalysts as well as for electrode structure variations. (Author abstract) 6 Refs.

CC 702.2 Fuel Cells; 815.1 Polymeric Materials; 802.2 Chemical Reactions; 704.2 Electric Equipment; 803 Chemical Agents; 423.2 Test Methods  
 CT \*Fuel cells; Polymeric membranes; Electrolysis; Catalysts; Materials testing; Electrodes  
 ST Electrocatalysts; Solid polymer proton exchange membrane (PEM) regenerative fuel cells  
 ET Ir\*Pt; Ir sy 2; sy 2; Pt sy 2; Pt-Ir; Pt; Ir; Ru; Rh; Na\*O\*Pt; Na sy 3; sy 3; O sy 3; Pt sy 3; NaxPt3O4; Na cp; cp; Pt cp; O cp

L78 ANSWER 16 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 1994:513257 HCAPLUS  
DN 121:113257  
ED Entered STN: 03 Sep 1994  
TI Development of the Mitsubishi planar reversible cell  
AU Nanjo, Fusayuki; Takenobu, Kouichi; Watanabe, Kiyoshi; Miyamoto, Hitoshi; Sumi, Masao; Tokunaga, Setsuo; Koshiro, Ikumasa  
CS Kobe Shipyard Mach. Works, Mitsubishi Heavy Ind. Ltd., Kobe, 652, Japan  
SO Sci. Technol. Zirconia V, [Int. Conf.], 5th (1993), Meeting Date 1992, 705-12  
CODEN: 59UVAJ  
DT Conference  
LA English  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology) Section cross-reference(s): 72  
AB The authors have proposed an energy storage system using reversible solid-oxide fuel cells and solid-oxide electrolysis cells, where the cells work alternately as fuel cells and as steam electrolysis cells. This paper describes the basic test facility and its results. Test cells were 23 mm in diam. and 200  $\mu$ m in thickness. Solid oxide electrolyte, 8 mol% Y2O3-stabilized ZrO2 (YSZ), was manufd. by a tape casting method. A Ni/YSZ cermet anode and a Sr-doped LaMnO3 cathode were both screen printed and sintered at elevated temps. A single cell was put in an elec. furnace and the temp. was maintained at 1000°. H and air were provided for fuel cell tests. Conversely, steam and air were provided for the electrolysis cell tests. For both conditions, polarization measurements were carried out using the current interruption method. Effects of electrode compns. on overpotentials and solid electrolyte degrdn. were also evaluated.  
ST fuel cell electrolytic cell hybrid  
IT Fuel cells  
(solid-state, hybrid with electrolytic cells, development and performance of planar)  
IT Electrolytic cells  
(solid-state, hybrid with fuel cells, development and performance of planar)  
IT 143107-06-6  
RL: USES (Uses)  
(anodes, fuel cell-electrolytic cell hybrid with, development and performance of planar)  
IT 110781-51-6, Lanthanum manganese strontium oxide (La0.9MnSr0.1O3)  
RL: USES (Uses)  
(cathodes, fuel cell-electrolytic cell hybrid with, development and performance of planar)  
IT 114168-16-0, Yttrium zirconium oxide (Y0.16Zr0.92O2.08)  
RL: USES (Uses)  
(electrolyte, fuel cell-electrolytic cell hybrid with, development and performance of planar)  
IT 1314-23-4, Zirconia, uses  
RL: USES (Uses)  
(yttria-stabilized, electrolyte, fuel cell-electrolytic cell hybrid with, development and performance of planar)  
IT 1314-36-9, Yttria, uses  
RL: USES (Uses)  
(zirconia stabilized with, electrolyte, fuel cell-electrolytic cell hybrid with, development and performance of planar)

L78 ANSWER 17 OF 29 INSPEC (C) 2006 IET on STN  
 AN 1993:4488445 INSPEC DN A1993-21-8630G-007; B1993-11-8410G-006  
 TI **Reversible solid polymer fuel cell**  
 AU Mahlendorf, F.; Peinecke, V.; Heinzl, A.; Ledjeff, K.  
 (Fraunhofer-Inst. for Solar Energy Syst., Freiburg, Germany)  
 SO Power Sources 14. Research and Development in Non-Mechanical  
 Electrical Power Sources. The 18th International Power Sources  
 Symposium, 1993, p. 273-80 of xii+387 pp., 19 refs.  
 Editor(s): Attewell, A.; Keily, T.  
 ISBN: 0 9512320 3 7  
 Published by: Int. Power Sources Symposium Committee, Leatherhead,  
 UK  
 Conference: Power Sources 14. Research and Development in  
 Non-Mechanical Electrical Power Sources. The 18th International  
 Power Sources Symposium, Stratford on Avon, UK, 19-21 April 1993  
 Sponsor(s): Joint Services Electrical Power Sources Committee  
 DT Conference; Conference Article  
 TC Experimental  
 CY United Kingdom  
 LA English  
 AB A reversible solid polymer cell operating both as a power source  
 and as an electrolyser might be a compact energy storage device for  
 a variety of applications. Special advantages are expected by using  
 the redox concept which has been developed at the  
 Fraunhofer-Institute for Solar Energy Systems. This concept means  
 operation of the electrodes in both oxidation and reduction modes  
 by reversion of the gases. As platinum is well-known to be the best  
 catalyst for oxygen reduction and hydrogen evolution (reduction  
 electrode), the authors' research has been focused on the  
 performance of the oxidation electrode. The tests of various  
 catalysts for oxygen evolution and hydrogen oxidation were carried  
 out in half-cell arrangements and subsequently the performance of  
 technical cells on cycling from fuel cell to **electrolysis**  
**mode** were studied  
 CC A8630G Fuel cells; A8245 Electrochemistry and electrophoresis;  
 B8410G Fuel cells  
 CT electrochemical electrodes; electrolysis; fuel cells  
 ST solar energy systems; hydrogen economy; fuel cell; reversible solid  
 polymer cell; power source; electrolyser; energy storage device;  
 electrodes; oxidation; reduction

L78 ANSWER 18 OF 29 JAPIO (C) 2006 JPO on STN  
 AN 1992-171667 JAPIO  
 TI FUEL CELL DEMONSTRATOR  
 IN SAITO MUTSUYA; NISHIZAWA NOBUYOSHI; INOUE SHINYA; NAKATO KUNIHIRO  
 PA SANYO ELECTRIC CO LTD  
 PI JP 04171667 A 19920618 Heisei  
 AI JP 1990-301740 (JP02301740 Heisei) 19901106  
 PRAI JP 1990-301740 19901106  
 SO PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol.  
 1992  
 IC ICM H01M008-00  
 ICS C25B005-00; H02J007-35  
 AB PURPOSE: To practically understand that the power generation of a  
 fuel cell is performed in quite the opposite mechanism to that of  
 the electrolysis of water by performing the electrolysis of water  
 and the power generation action of the fuel cell in turn in a single  
 electrolysis/**fuel cell** section via only the  
**transfer of a switch.**  
 CONSTITUTION: A transfer switch 19 is set to the feed mode side, and

the light from a light source is radiated to a solar cell panel 17. The solar cell panel 17 generates the photoelectromotive force, and its power is fed to an electrolysis/fuel cell section 12 via the switch 19 and a wattmeter 20 as the output of a power source section 21 together with the power from a battery 22. When the transfer switch 19 is set to the power generation mode side, the electrolysis/ fuel cell section 12 is operated as a fuel cell using the hydrogen and oxygen generated in the feed mode for the power generation by the fuel cell. It can be practically understood that the fuel cell generates power in quite the opposite action to that of the electrolysis of water.

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L78 ANSWER 19 OF 29 INSPEC (C) 2006 IET on STN  
AN 1993:4338706 INSPEC DN A1993-06-8630D-001; B1993-03-8410-001  
TI Reversibility and polarization behaviour of high temperature solid oxide electrochemical cells  
AU Erdle, E.; Donitz, W.; Schamm, R.; Koch, A. (Dornier GmbH, Friedrichshafen, Germany)  
SO International Journal of Hydrogen Energy (Oct. 1992), vol.17, no.10, p. 817-19, 4 refs.  
CODEN: IJHEDX, ISSN: 0360-3199  
Price: 0360-3199/92/\$5.00+0.00  
DT Journal  
TC Experimental  
CY United Kingdom  
LA English  
AB Experimental data of cells and cell stacks are presented which clearly demonstrate that their operation can be reversibly changed from the electrolysis mode to the fuel cell mode and vice versa without any discontinuity. Polarization measurements are reported showing that the polarization in fuel cell operation is lower than that in electrolysis operation, especially at operating temperatures below the standard temperature of 1000°C. An experimental technique for discrimination between the individual polarization losses at the air and fuel electrodes is described and corresponding results are given  
CC A8630D Electrochemical conversion; B8410 Electrochemical conversion and storage  
CT cells (electric); polarisation  
ST reversibility behaviour; air electrodes; polarization behaviour; high temperature; solid oxide electrochemical cells; electrolysis mode; fuel cell mode; polarization losses; fuel electrodes  
ET C

L78 ANSWER 20 OF 29 COMPENDEX COPYRIGHT 2006 EEI on STN  
AN 1993(2):17791 COMPENDEX DN 930222480  
TI Advances in the use of perfluorinated cation exchange membranes in integrated water electrolysis and hydrogen/oxygen fuel cell systems.  
AU Holze, Rudolf (Carl von Ossietzky Universitat Oldenburg, Oldenburg, Germany); Ahn, Jochen  
SO J Membr Sci v 73 n 1 Oct 2 1992 p 87-97  
CODEN: JMESDO ISSN: 0376-7388  
PY 1992  
DT Journal  
TC Experimental  
LA English  
AB The application of a perfluorinated cation exchange membrane



(Nafion(R) 117) in electrochemical cells suitable for **alternative** operation as water electrolyser and hydrogen/oxygen fuel cell was investigated. Various methods used for the preparation of membrane-electrode units were applied; the performance of the units prepared with these methods in fuel cell and electrolyser **modes** of operation is evaluated. Inherent advantages of a direct preparation of the catalyst layer on the membrane surface by chemical deposition could be realised only in case of platinum electrodes. In case of all other electrode materials including various noble metals and their oxides (pure or in binary composition) suitable membrane-electrode units were fabricated from PTFE-bonded catalyst layers subsequently pressed onto the membrane. Experimental results obtained with respect to performance and longtime stability are reported and discussed; further lines of development are indicated. (Author abstract) 24 Refs.

CC 631 Fluid Flow & Hydrodynamics; 817 Plastics, Products & Applications; 802 Chemical Apparatus & Plants; 702 Electric Batteries & Fuel Cells

CT \*POLYMERIC MEMBRANES; WATER; ION EXCHANGE MEMBRANES; FLUORINE CONTAINING POLYMERS; ELECTROLYSIS; FUEL CELLS

ST PERFLUORINATED CATION EXCHANGE MEMBRANES; HYDROGEN-OXYGEN FUEL CELLS; WATER ELECTROLYSIS

L78 ANSWER 21 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1992:63528 HCAPLUS

DN 116:63528

ED Entered STN: 21 Feb 1992

TI Hydrogen-oxygen/water electrolyzer and fuel-cell system for **energy storage** and power generation

IN Ahn, Jochen; Ledjeff, Konstantin

PA Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Germany

SO Ger., 8 pp.

CODEN: GWXXAW

DT **Patent**

LA German

IC ICM C25B001-04

ICS C25B009-00; C25B011-06; C25B011-12; H01M008-08; H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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PI	DE 4027655	C1	19911031	DE 1990-4027655	19900831
				<--	
	EP 472922	A2	19920304	EP 1991-112594	19910726
				<--	
	EP 472922	A3	19920909		
	EP 472922	B1	19940928		
	R: DE, FR, GB, IT				
	US 5316643	A	19940531	US 1992-908907	19920702
				<--	
PRAI	DE 1990-4027655	A	19900831	<--	

US 1991-751444 B1 19910830 <--

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
DE 4027655	ICM	C25B001-04
	ICS	C25B009-00; C25B011-06; C25B011-12; H01M008-08; H01M008-06
	IPCI	C25B0001-04 [ICM,5]; C25B0009-00 [ICS,5]; C25B0011-06 [ICS,5]; C25B0011-12 [ICS,5]; H01M0008-08 [ICS,5]; H01M0008-06 [ICS,5]
	IPCR	H01M0004-86 [I,A]; H01M0004-86 [I,C]; H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-18 [I,A]; H01M0008-18 [I,C]
EP 472922	IPCI	H01M0008-18 [ICM,5]; H01M0008-04 [ICS,5]
	IPCR	H01M0004-86 [I,A]; H01M0004-86 [I,C]; H01M0008-04 [I,A]; H01M0008-04 [I,C]; H01M0008-18 [I,A]; H01M0008-18 [I,C]
	ECLA	H01M008/04C2; H01M008/18C2
US 5316643	IPCI	C25B0009-00 [ICM,5]
	NCL	204/265.000; 204/266.000; 204/290.140; 204/290.150; 204/DIG.004; 429/030.000; 429/033.000; 429/034.000; 429/039.000; 429/045.000
	ECLA	H01M004/86B4; H01M008/04C2; H01M008/18C2

AB The title system comprises an anode space, a cathode space, an ion-exchange electrolyte membrane, a bifunctional oxidn. electrode in the anode space, a bifunctional redn. electrode in the cathode space, and auxiliary means including conduits, flow control valves, O and H storage tanks, gas driers and pumps. The catalyst layer on the bifunctional oxidn. electrode includes Pt, Ir, Rh, Ru, Pd, Os, Re, and/or their alloys and/or their oxides. By switching the operation of electrolyzer/fuel-cell reactions, the system is used for energy saving and power generation, resp. Operations of the system in the energy saving and power generation modes are detailed.

ST hydrogen oxygen electrolyzer fuel cell

IT Electrolytic cells

(for hydrogen and oxygen manuf. and storage, fuel cells and)

IT Fuel cells

(hydrogen-oxygen, electrolyzers for hydrogen and oxygen manuf. and storage and)

L78 ANSWER 22 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1991:562973 HCAPLUS

DN 115:162973

ED Entered STN: 18 Oct 1991

TI Some battery applications of solid electrolytes in Japan

AU Takahashi, Takehiko

CS Nagoya Univ., Nagoya, 465, Japan

SO Materials Research Society Symposium Proceedings (1991), 210(Solid State Ionics 2), 3-11

CODEN: MRSPDH; ISSN: 0272-9172

DT Journal; General Review

LA English

CC 52-0 (Electrochemical, Radiational, and Thermal Energy Technology)

AB A review with 20 refs. of solid electrolyte uses in Japan includes: ion conduction of Ag, Cu, and Li and Li+ conductive polymer

electrolytes; large capacity batteries for elec. **energy storage**; solid **electrolyte fuel cells**; and alkali metal thermoelec. **converters**.

ST review solid electrolyte battery Japan; fuel cell solid electrolyte review; thermoelec **converter solid electrolyte** review

IT Batteries, primary  
Batteries, secondary  
(solid-electrolyte, development and use of, in Japan)

L78 ANSWER 23 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 1982:566079 HCAPLUS  
DN 97:166079  
ED Entered STN: 12 May 1984  
TI Alkaline regenerative fuel cell **energy storage** system for manned orbital satellites  
AU Martin, R. E.; Gitlow, B.; Sheilbley, D. W.  
CS United Technol. Corp., South Windsor, CT, 06074, USA  
SO Proceedings of the Intersociety Energy Conversion Engineering Conference (1982), 17th(Vol. 2), 790-5  
CODEN: PIECDE; ISSN: 0146-955X  
DT Journal  
LA English  
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)  
AB The title system can feature fuel-cell and electrolysis-cell modules or an integrated fuel cell-electrolysis cell module. The regenerative fuel-cell system consists of a fuel-cell module, an electrolysis-cell module, reactant- and water-storage tanks, and connecting plumbing. The input power to the electrolyzer is supplied by a solar array. This system offers the advantages of being highly efficient, reliable, maintainable, and easily integrated into the spacecraft. In addn. to providing **energy storage**, the regenerative system can provide H and O for altitude control of the vehicle and life support for the crew. The integrated **fuel cell-electrolysis** cell energy system is an **alternative** approach for the regenerative **fuel-cell** system. The integrated system features modules incorporating fuel-cell and electrolysis-cell units.

ST satellite fuel cell system; solar array fuel cell system  
IT Photoelectric devices, solar  
(array of, fuel-cell system for manned orbital satellites contg., alk. regenerative)

IT Fuel cells  
(hydrogen-oxygen, system of alk. regenerative, for manned orbital satellites)

L78 ANSWER 24 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 1978:481915 HCAPLUS  
DN 89:81915  
ED Entered STN: 12 May 1984  
TI Effect of active layer composition on the catalytic activity of two-**layer diffusion** electrodes for the **reduction** of oxygen in acid electrolytes  
AU Kretzschmar, C.; Wiesener, K.; Kaisheva, A.; Iliev, I.  
CS Sekt. Chem., Tech. Univ. Dresden, Dresden, Ger. Dem. Rep.  
SO Journal of Power Sources (1978), 2(4), 361-8  
CODEN: JPSODZ; ISSN: 0378-7753  
DT Journal  
LA German

CC 72-2 (Electrochemistry)  
Section cross-reference(s): 67

AB A 2-layer electrode for O redn. in acid electrolytes is described. Wet-proofed C black or Teflon were used as the binder and both types of active layer were compared with each other with respect to their electrochem. properties. The amts. of binder material and catalyst were also varied, as well as the layer thickness. The highest activity was shown by the type 2 active layer in which a Teflon suspension was used as the binder material. With this layer in 4.5N H2SO4 electrolyte at a potential of UH = 700 mV, a loading of 20 mA/cm2 could be maintained with air and 30 mA/cm2 with O, at room temp.

ST catalytic redn oxygen acid; electroredn oxygen sulfuric acid; Teflon oxygen electroredn; carbon black oxygen electroredn; **fuel cell** electrocatalyst

IT Carbon black, uses and miscellaneous  
RL: USES (Uses)  
(binder from wet-proofed, for redn. catalyst for oxygen in acid solns.)

IT Binding materials  
(for redn. catalyst, for oxygen in acid solns.)

IT Reduction, electrochemical  
(of oxygen, in acid electrolytes, 2-layer diffusion electrodes for)

IT Reduction catalysts  
(electrochem., for oxygen in acid electrolytes, active layer compn. effect on activity of 2-layer diffusion)

IT Electrodes  
(**fuel-cell**, active layer compn. effect on catalytic activity of 2-layer diffusion, for oxygen redn. in acid electrolytes)

IT 9002-84-0  
RL: PRP (Properties)  
(binder, for redn. catalyst for oxygen in acid solns.)

IT 132-16-1  
RL: CAT (Catalyst use); USES (Uses)  
(redn. catalyst, for oxygen in acid solns.)

IT 7782-44-7, reactions  
RL: RCT (Reactant); RACT (Reactant or reagent)  
(redn. of, electrochem., in acid electrolytes, 2-layer diffusion electrodes for)

L78 ANSWER 25 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1978:25562 HCAPLUS

DN 88:25562

ED Entered STN: 12 May 1984

TI An off-peak **energy storage** concept for electric utilities: Part II - The water battery concept

AU Clifford, J. E.; Brooman, E. W.; Sulzberger, V. T.; El-Badry, Y. Z.

CS Battelle's Columbus Lab., Columbus, OH, USA

SO Applied Energy (1977), 3(4), 233-55  
CODEN: APENDX; ISSN: 0306-2619

DT Journal

LA English

CC 52-3 (Electrochemical, Radiational, and Thermal Energy Technology)

AB The water battery (**reversible H2O electrolyzer**) is a single **energy storage** device for use on an elec. utility system at dispersed locations such as substations. Available off-peak elec. energy can be used to electrolyze H2O, and the produced H and O are stored externally. These gases can be

recycled through the same device operating in reverse to generate d.c. electricity to meet peak-load demands of the utility system. A conceptual design is formulated for a 10-MW water battery installation compatible with the requirements of a utility system. General design approaches and cost ests. are developed for the basic battery module, the **energy storage** subsystem, and the power conditioning subsystem.

ST load leveling water battery

IT **Electrolytic cells**

(water, load leveling with **reversible**)

IT **Fuel cells**

(hydrogen-oxygen, load leveling with **reversible**)

IT Power

(plants, load leveling in, water-battery concept for)

L78 ANSWER 26 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1977:57943 HCAPLUS

DN 86:57943

ED Entered STN: 12 May 1984

TI A water-battery concept for electric utility **energy storage**

AU Clifford, J. E.; Brooman, E. W.

CS Battelle Columbus Lab., Columbus, OH, USA

SO Proc. Symp. Energy Storage (1976), Meeting Date 1975, 179-97.

Editor(s): Berkowitz, Joan B.; Silverman, Herbert P. Publisher: Electrochem. Soc., Inc., Princeton, N. J.

CODEN: 34BQAM

DT Conference

LA English

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

AB The water battery (**reversible water electrolyzer**

or regenerative H-O fuel cell) is a single

**energy-storage** device with long operational life

and high storage efficiency suitable for use on an elec. utility system at dispersed locations, e.g., substations. The tech. and economic feasibilities of such a device are considered and found to be attractive for load-leveling applications. Capital cost ests. are presented for a daily and a weekly duty cycle, based on estd. near-term and projected long-term performance goals.

ST **energy storage** fuel cell; utility **energy**

**storage**; water electrolyzer **energy storage**

; hydrogen oxygen fuel cell electrolyzer

IT Electrolytic cells

(for water, hydrogen-oxygen fuel cell and, for load leveling)

IT Fuel cells

(hydrogen-oxygen, water electrolyzer and, for load leveling)

L78 ANSWER 27 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN

AN 1971:557641 HCAPLUS

DN 75:157641

ED Entered STN: 12 May 1984

TI Electrical energy source containing **fuel cells** and electrodes

IN Epstein, Sheldon L.; Wessling, Bernard W.

PA Brunswick Corp.

SO Ger. Offen., 18 pp.

CODEN: GWXXBX

DT **Patent**

LA German

IC H01M



CC 77 (Electrochemistry)

FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	DE 2037358		19710527	DE 1970-2037358	19700723
	CA 968026			CA	
	GB 1312658			GB	
	GB 1312659			GB	
	GB 1312660			GB	
	US 3660888		19720509	US	19690724
	US 3826686		19740730	US 1971-160169	19710706

PRAI US

CLASS

PATENT NO.	CLASS	PATENT FAMILY CLASSIFICATION CODES
DE 2037358	IC IPCI IPCR	H01M H01M H01M0004-00 [I,A]; H01M0004-00 [I,C]; H01M0004-86 [I,A]; H01M0004-86 [I,C]; H01M0008-08 [I,A]; H01M0008-08 [I,C]; H01M0008-14 [I,A]; H01M0008-14 [I,C]
US 3660888	IPCR  NCL	H01M0004-00 [I,A]; H01M0004-00 [I,C]; H01M0004-86 [I,A]; H01M0004-86 [I,C]; H01M0008-08 [I,A]; H01M0008-08 [I,C]; H01M0008-14 [I,A]; H01M0008-14 [I,C] 029/623.100; 029/419.100; 228/170.000; 419/002.000; 419/009.000; 419/036.000; 427/180.000; 427/376.700; 427/376.800; 429/103.000
US 3826686	IPCR  NCL	H01M0004-00 [I,A]; H01M0004-00 [I,C]; H01M0004-86 [I,A]; H01M0004-86 [I,C]; H01M0008-08 [I,A]; H01M0008-08 [I,C]; H01M0008-14 [I,A]; H01M0008-14 [I,C] 429/040.000

AB The active surface of the electrodes consists of fine metallic fibers, coated with a thin layer of electrolyte, so as to offer ease of diffusion to the gas. A large active surface and thin diffusion layer, which serve to reduce the electrode overvoltage, are claimed.

ST fuel cell elec energy source; electrode fuel cell; overvoltage redn fuel cell

IT Fuel cells (electrodes)

IT Electrodes (fuel-cell)

L78 ANSWER 28 OF 29 HCAPLUS COPYRIGHT 2006 ACS on STN  
AN 1966:82080 HCAPLUS  
DN 64:82080  
OREF 64:15369a  
ED Entered STN: 22 Apr 2001  
TI **Energy storage** based on electrolyzers and H-O  
fuel cells  
AU Bacon, F. T.  
CS Natl. Res. Develop. Cor., London  
SO Proc. U.N. Conf. New Sources Energy, Rome, 1961 (1963), 1, 174-80  
DT Journal  
LA English  
CC 15 (Electrochemistry)  
AB A general discussion of processes and economics of power stations  
that use fuel cells and store energy as O and H gas. Research is  
advocated to develop **reversible electrolyzer-**  
**fuel cell** combinations. Several methods of gas  
storage are also evaluated.  
IT Cells, voltaic  
(fuel, power from combined electrolytic cells and)  
IT Power  
(generation of, from combined electrolytic cells and fuel cells)  
IT Cells, electrolytic  
(power from combined fuel cells and)

L78 ANSWER 29 OF 29 JAPIO (C) 2006 JPO on STN  
AN 2005-327613 JAPIO  
TI FUEL CELL  
IN SHA TAKESHI  
PA AISIN SEIKI CO LTD  
PI JP 2005327613 A 20051124 Heisei  
AI JP 2004-145026 (JP2004145026 Heisei) 20040514  
PRAI JP 2004-145026 20040514  
SO PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol.  
2005  
IC ICM H01M008-02  
ICA H01M008-10  
AB PROBLEM TO BE SOLVED: To provide a fuel cell in which the pressure  
drop of a **diffusion layer** is **reduced**,  
and the manufacturing cost of a separator is reduced.  
SOLUTION: A fuel cell includes a flat plate-shaped electrolyte 1, a  
fuel pole catalyst layer 2 provided at one side of the electrolyte  
1, an oxidizer pole catalyst layer 3 provided at the other side of  
the electrolyte 1, and a **fuel diffusion**  
**layer** 4 provided at catalyst at the back surface relative to  
the electrolyte 1 side of the fuel pole catalyst layer 2, and an  
oxidizer pole diffusion layer 5 provided at the back surface  
relative to the electrolyte 1 side of the oxidizer pole catalyst  
layer 3. A flow passage space 51 is provided, in which a fluid  
containing an active material circulates through at least one  
diffusion layer out of the **fuel diffusion**  
**layer** 4 and the oxidizer pole diffusion layer 5.  
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